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CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Briefly Told 965

Annual Meeting, Society of Gas Lighting—Progress in the Matter of the Gas Exhibition—Death of Mr. J. S. Ambrose—Exit the Consumers Fuel Gas, Heat and Power Company—Notes.

Report of the Committee on Education, American Gas Light Association, Submitted at the St. Louis Meeting, October, 1896 966

*Woods' Safety Device for Gas Producers 967

Domestic Illumination by Means of Gas, by Vivian B. Lewes, F.I.C., F.C.S. 968

Illuminating Power, as Exhibited in the Parliamentary Returns, by Mr. Thos. Newbigging 972

Rustless Coatings for Iron and Steel, by Mr. M. P. Wood 973

The Sources of Error in Mine Surveys 975

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 976

The Newark (O.) Company Changes Owners—Possible Sale of the Decatur (Ills.) Plant—Annual Meeting, Lancaster, Pa.—Capital Stock Increased, Ilion, N. Y.—Dollar Gas for Chicago—Contract for the Berlin Iron Bridge Company—The Residents of Pullman, Ills., Want Cheaper Gas—Another Instance of How Changes in Politics Result—Taunton, Mass., Votes for Municipal Electric Lighting—To Pursue Business Methods in Gas Supply, New London, Conn.—Something from Saratoga Springs, N. Y.—Annual Meeting, Carondelet Company, St. Louis, Mo.—The Albo-Carbon Light Company—The Englewood (N. J.) Company Engages in Electric Lighting Supply—The Grant Under which the Houston (Texas) Company Works—A Hint from Columbus, Ohio—Will Dover, N.J., Have a Gas Works?—The Spanish-American Light and Power Company—Bid for Public Lighting, Erie, Pa.—Something from Chicopee, Mass.—Discussing Gas Rates, Salt Lake City—And Many Other Items.

Air in the London Underground Railway 977

The Market for Gas Securities 978

BRIEFLY TOLD.

ANNUAL MEETING, SOCIETY OF GAS LIGHTING.—The annual meeting of the Society of Gas Lighting was held in this city on the afternoon of the 10th inst., the attendance being notable in point of numbers and representativeness. The proceedings were directed by the Vice President, Mr. Eugene Vanderpool, whose announcement to the Society of the death of its President, Mr. Joseph Russell Thomas, was a most eloquent tribute to the memory of deceased. The Society, in accordance with the suggestions of the Vice-President, took appropriate action respecting an expression by the Society of the loss sustained by it in the death of Mr. Thomas. Amongst the routine business transacted was the election of officers for the ensuing year, the ballot resulting as follows:

President—Eugene Vanderpool, Newark, N. J.
Vice-President—A. M. Smith, New York City.
Treasurer—D. D. Flemming, Jersey City, N. J.
Secretary—Col. Fred. S. Benson, Brooklyn, N. Y.

The annual dinner terminated the proceedings. It is possible that some changes in the autonomy of the Society will be perfected in the coming year.

PROGRESS IN THE MATTER OF THE GAS EXHIBITION.—There can be no doubt now that the proposed exhibition by "The Gas Industries Company," at the Madison Square Garden this winter (for the time and place thereof, see our advertising columns), will be carried out to the end, and successfully; for the local gas interests have determined that it shall not fail as an exposition of that which gas, consumed or used under sensible practice, can be always counted on to accomplish in the home, the shop or the factory. The applications for and allotments of space to intending exhibitors of appliances that advance the efforts of the gas manufacturer or aid the consumer in his adaptation of the product which the gas man affords him, have been such that of empty booths there will be none. Nor have the proprietors of the exhibition been behindhand in arranging for the presentation of novelties that, while attracting the attention of even the casual visitor, will cause the latter to permanently hold the belief that electric light is not all that glitters. The Messrs. Tiffany, of New York, who have been paying much attention of late years to the development in this country of artistic effects in glass, have agreed to show, in the shape of a "gas tower" at the Exhibition, how harmoniously glass and gas may blend in decorative illumination; and perhaps a more effective, even if less artistic showing, will come to the ordinary gas man, from an inspection of the "Historical Exhibit," the scope of which is laid out to include, by means of actual progressive examples, the growth of the gas business during the one century of its time. Indeed, under the plan of the exploiters of the Exhibition, there will be enough on show to interest the grave, the gay and the practical. The Ohio Gas Light Association having agreed to hold its annual meeting in New York, during the time of the Exhibition, on February 3d and 4th, the managers of the Exhibition have named the evening of Wednesday, February 4th, "Gas Men's Night," for which reunion a special programme is promised. The Executive Committee of the Western Gas Associa-

tion will also meet in New York during the first week in February, to arrange for the meeting in Cincinnati next May of that body; so it may be taken for granted that "Gas Men's Night" will lack none of the features that emphasize fraternality. A fact assured, in connection with this mention, that should have been stated before, is that the "Tiffany Gas Tower," having done service at the Madison Square Garden this winter, will, in 1900, at the projected World's Fair in Paris, France, represent the contribution of the American gas industry to the glories in that exposition of all that is best in contemporary working.

DEATH OF MR. J. S. AMBROSE.—We are in receipt of a rather disconnected account of the death of Mr. J. S. Ambrose, who passed away at Paris, Texas, on the afternoon of December 8th, the mention of whose death will not likely arouse much attention in the district east of the Ohio river, nor possibly will it recall many active memories in the West; for he was not a man who gave himself greatly to counselling with others. Nevertheless, in the decade of 1880–1890, he was quite prominent in the gas business of Missouri, and was well and favorably known to the earliest members in the Western Gas Association, his admission to which body was made at the meeting held in St. Louis, May, 1881. Our first record of Mr. Ambrose dates from his connection with the Company at Jefferson City, Mo., in 1882, in which year he removed to Springfield, Mo. He established the gas works at that point, and soon became identified with the best business life of the place. He was a Director in the Bank of Springfield and had also been President of the Commercial Bank of the same city. He was the originator of the Springfield Ice and Refrigerator Company, and to this line of industry the finishing years of his life were devoted. Something over a year ago, having disposed of his business interests in Springfield, he went to Paris, Texas, following there pretty much along the same line over which he had travelled in Springfield. One son, a resident of Dallas, Texas, survives him. The remains were removed to Springfield, Mo., where interment was made.

EXIT THE CONSUMERS FUEL GAS, HEAT AND POWER COMPANY.—It would seem that the "Comedy of Errors," relevant to the appearance of the projectors of the Consumers Fuel Gas, Heat and Power Company, before the Board of Aldermen of this city last spring, for a franchise to manufacture and distribute fuel gas in New York, the subsequent legal proceedings to restrain the Board of Aldermen from giving the grant asked for, and the final sanction by the Board of the grant, was brought to an end on the 15th inst., when the Board recalled from Mayor Strong the franchise, just at the moment when that high official was presiding over a public hearing, the upshot of which would presumably determine whether the Mayor would sign the franchise or veto it. The merits of the case are not worth while discussing here, simply for the reason that it had no "merits," nor was there any likelihood that New York city would ever be supplied with fuel gas under the terms of the grant applied for by the projectors of the Consumers Fuel, etc., Company, which application now rests calmly in the custody of the Board, without even the semblance of a "heat unit" to warm it back to the squirming point. The application, however, proves one thing anew, and that is the seeming ease with which men of sagacity in some lines of trade are entrapped to devote themselves to other lines of trade respecting which they know absolutely nothing. The named President of this Consumers Fuel aggregation is Mr. Milo M. Belding, who probably knows as much (yes, more) about the manufacture and sale of silk threads for sewing use as any other living man. He is a man of repute, of probity, of wealth; yet, once outside of his own special line of business, he can be said to have made of himself a laughing stock, for no sane gas man can read his presentation of the case of the Consumers Company, before the Mayor's public hearing, without smiling just a little. Mr. Belding, however, had able support, in respect of exciting the risibilities of the real gas men who were on hand, on account of the expert testimony read by the Mayor, which expert testimony was solicited by his Honor for his partial guidance. We would respectfully advise Mr. Belding to stick to silk twist, or even to forwarding the interests of life insurance on company account (in which honorable pursuit we believe Mr. Belding is also engaged), for it is painfully evident that of the gas trade he knows nothing.

NOTES.—The judgment for $12,500 against Mr. Charles B. Bailey, as Secretary of the Washington (D. C.) Gas Light Company, and Mr. John Leetch, as General Manager of the same Company, secured some months ago by Mr. Thomas G. Lansden, who charged the defendants with having libeled him, has been sustained on appeal to the Court of Appeals of the District of Columbia. The libel was the result of the publication of an article charging Mr. Lansden with having uttered certain testimony before the Committee of Congress that was investigating the gas supply of Washington, that Mr. Lansden had not given, as was shown during the trial of the case.——The Knoxville (Tenn.) Company has completed important main extensions in the northern section of that city.——The Gowanda Gas Company has been organized to supply gas to the districts of Gowanda and Collins, in Erie county, and Persia, Cattaraugus county, N. Y.

Report of the Committee on Education, American Gas Light Association, submitted at the St. Louis Meeting, October, 1896.

To the American Gas Light Association—Gentlemen: Your Committee on Education, appointed in October, 1895, and composed of the undersigned, have the honor to report as follows:

The Committee met for the first time in January, 1896, and on February 10th issued to the members of the Association a circular calling attention to the action of the Association in the matter of education and detailing the work the Committe hoped to accomplish. Accompanying this circular was a form of application for membership in the practical class, which the Committee proposed to create. The responses to this circular were numerous, and resulted in 76 applications for membership.

On March 1st a list of questions was sent out to the 76 members, and 65 members answered. In June the second list of questions was sent out with the Committees' answers to the first list, and a circular letter to the members of the Class. The third list of questions, with the answers to the second list, and a circular to the members of the Class have just been mailed. Copies of these various papers are attached hereto.

Of the 76 who have made application for membership, 44 have answered the second list of questions, and it is believed by the Committee that these members are earnest in their work and will continue their membership throughout the course proposed. There are in addition 7 applications which will be acted upon, the applicants being made members of the Class from the beginning of the Class year, December, 1896. The Class is much larger than the Committee had anticipated, and the interest shown in the work is very gratifying. The lists of questions include the entire field of gas engineering, and contain about 20 questions each. As the answers are received they are read by the Committee, and individual letters are written to members where there is anything in the answers indicating that the member is not understanding the questions, or is in need of special suggestions to help him in his work.

Many letters received from members, expressing their appreciation of the opportunity the Association affords them to improve themselves in the knowledge of their business, are on file with the Chairman.

The work up to this point has been experimental and preparatory. From the 1st of December next the regular work of the Class begins. It is proposed to send out four lists of questions a year, and to have these questions cover the entire range of the duties of the gas superintendent. The Committee believe that the good that can be obtained by a member of the Class from work in the Class is in but small part the privilege of receiving the answers to the questions. The greater good must come from the familiarity with the books and from the mental training that he will get from working up his answers. With many of the Class the greatest good of all will probably be the clearing up of ideas that comes from their exact expression in writing.

The Committee referred in one of their circulars to the matter of prizes. After serious consideration they have come to the conclusion that it will be better to expend whatever money may be at their command in such work as will benefit all of the Class, rather than for the purchase of prizes which can benefit but few, and very possibly those who, all things considered, are less needful of assistance. Therefore, with your approval, the Committee will abandon the idea of giving prizes, and will expend such funds as may come into their possession for the purpose, in circulating among the members such literature as they may be able to command and think will be of value to the Class.

The Committee have further to report that the expenses in connection with the work have so far amounted to something less than $200, and that this money has been raised within the Committee.

The Committee believe the work is doing a great deal of good, and trust that you will see fit to have it continued.

The Committee regret to report so far that they have not had any notice of work being done in direction of original research.

WALTON CLARK, Chairman,
A. C. HUMPHREYS,
A. E. FORSTALL,
C. F. PRICHARD,
A. B. SLATER, JR., Sec., *ex-officio*,
} Committee.

Woods' Safety Device for Gas Producers.

On October 27th last, U. S. Letters Patent (No. 570,149) were granted to Mr. George E. Woods, of New York, for certain improvements in safety devices for gas producers. Using the words of the specification:

My invention relates to apparatus used in the manufacture of water gas, and in which there is an alternate production of water gas and of fuel gas, the latter gas being produced in the process of bringing the generator and connected parts of the apparatus to a proper temperature for the production of water gas. In the process of bringing the apparatus to a properly high temperature for the production of water gas,

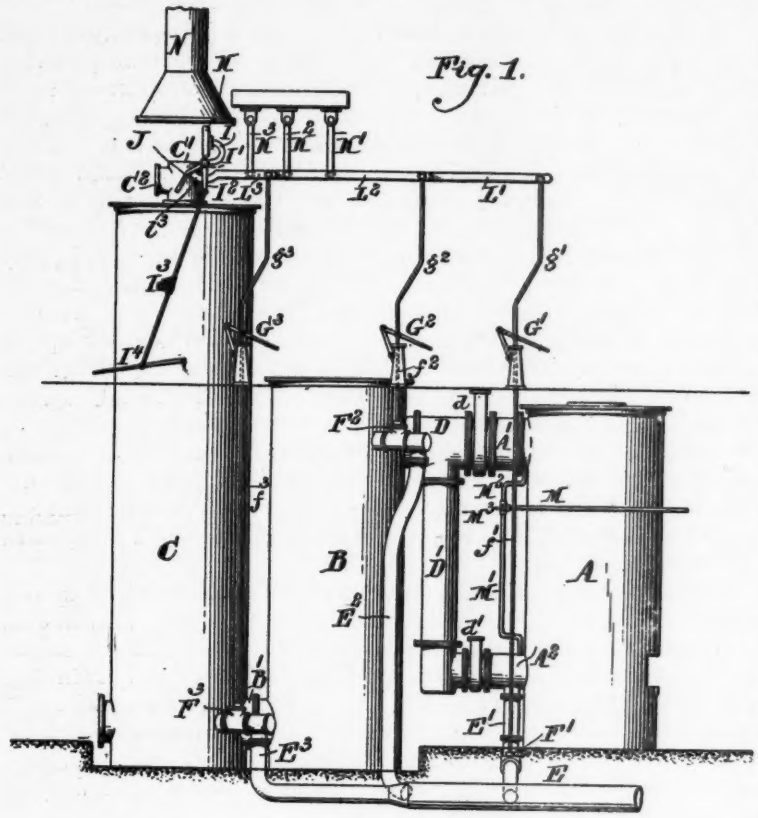

Fig. 1.

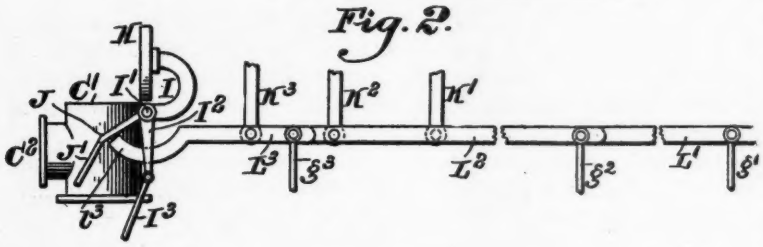

Fig. 2.

Fig. 3.

Fig. 4.

air is forced into the generator and into the parts generally known as the "carbureting" and "fixing" chambers; while in the manufacture of water gas, steam is forced into the generator and the air cut off from all parts of the apparatus traversed by the water gas, and in case, by inadvertence or otherwise, air is not excluded from the apparatus while water gas is being manufactured, there is danger of the formation and ignition of an explosive mixture of water gas and air, which is not only perilous to those employed about the apparatus, but also endangers the apparatus itself.

Now, the object of my invention is to provide means by which the danger of the formation of an explosive mixture in the apparatus is avoided, and this I accomplish by interlocking the blast valves, which control the admission of air to the various parts of the apparatus, with the valve controlling the take-off pipe, through which the products of combustion are led away from the apparatus, and I effect this interlocking of the parts referred to in such a way as either to prevent the closing of the take-off valve as long as any of the blast valves are open, or to prevent the opening of any of the blast valves as long as the take-off valve is closed. Preferably I effect the interlocking in such a way as to accomplish both of the functions above noted.

The precise character of the interlocking mechanism employed may be very greatly varied, and obviously the interlocking mechanism may be connected, either with parts of the apparatus which convey motion to the valves in question or with parts of the apparatus actuated by the motion of the said valves, these being but improvements of mechanical skill and capable of great variation.

In the drawings which form a part of this specification I have shown an interlocking device of simple and efficient construction, which has been found to give satisfactory service in practical use and which embodies my invention in a form which provides for both of the functions hereinabove described.

Reference being now had to the drawings, Fig. 1 is an elevation of a gas producing apparatus provided with an interlocking device embodying my invention. Fig. 2 is an enlarged view of a portion of the apparatus shown in Fig. 1; Fig. 3, a plan view of the devices shown in Fig. 2, and Fig. 4 a perspective view of the interlocking device illustrated in the other figures.

A is a water gas generator, and, as shown, is provided with take-off pipes both at top and bottom (indicated at A^1 and A^3) *D* being a conduit through which the gases pass to the carbureting chambers (indicated at *B*), and this pipe *D* being connected directly with the conduit A^1 and through branch D^1 with the conduit A^2, *d* and d^1 being valves situated in the conduits A^1 and A^2, by which either can be closed at will.

B, as already mentioned, is in the plan shown a carbureting chamber connecting through a conduit B^1 with a fixing chamber *C*. As all of the chambers, *A*, *B* and *C*, are of familiar and usual construction, I have not thought it necessary to indicate their internal construction.

At the top of the fixing chamber *C* is a take-off pipe C^1, having, as shown, an opening at its top leading into a stack *N* and a lateral opening C^2, through which water gas is led to any convenient purifying and storing device.

E is an airblast pipe having, as shown, a branch E^1, leading into the bottom of the generator through the pipe A^2, a branch E^2, leading into the top of the carbureting chamber, and a branch E^3, leading into the bottom of the fixing chamber.

F^1, F^2 and F^3 are valves by which the various branches of the blast pipe are opened and closed at will, and which I will refer to as "blast valves." These valves are actuated, as shown, by the levers G^1, G^2 and G^3; f^1, f^2 and f^3 indicating the connections between the levers and the valves, and g^1, g^2 and g^3 indicating connections between the levers and a corresponding system of levers L^1, L^2 and L^3, each of which, as shown, is pivoted to rods K^1, K^2 and K^3, depending from a support above the levers, for instance, the roof of the building. The ends, l, l^2 and l^3 of the pivoted levers are, as shown, formed in the shape of a segment of a circle and not in the same plane.

H is a valve by which the blast opening in the pipe C^1 is closed or opened, and I will refer to this valve hereinafter as the "take-off" valve. It is, in the construction illustrated secured by a lever arm *I*, to a transverse operating shaft I^1, to which shaft is also secured a lever arm I^2, from which a connection I^4 leads to an actuating lever I^5. To the shaft I^1 is secured, in the plan illustrated, a locking device *J*, having a transversely extending face plate J^1 and an open space indicated at J^2 between said face plate and the shaft I^1. The ends, l^1, l^2 and l^3, of the pivoted levers, are brought into such relation with the locking device *J* that when the said pivot levers are in the position occupied by them when the blast valves are closed they will not interfere with the free motion of the locking device *J* or of the take-off valve *H;* but in case of the movement of any of the pivoted levers to the position it occupies when its corresponding blast valve is open, then its end will come opposite to the face plate J^1, and prevent the closing of the take-off valve *H*, and by this interlocking I effectually prevent the closing of the take-off valve so long as any of the blast valves are open.

My reason for forming the ends, l^1, etc., of the pivoted levers with the curved shape, as illustrated, is so that in case the valve *H* is closed or only partly open it will be impossible to open any of the blast valves, and it will be seen that when the valve *H* is closed and the face-plate J^1 moved downward and backward the top of this plate will lie in contact with or in close proximity to the curved ends of the pivoted levers and will prevent these curved ends from moving downward; but as a downward motion of the curved ends of the pivoted levers is a neces-

sary consequence of the inward movement of their pivoted ends it is thus obvious that the pivoted levers are locked in position and through them the blast valves locked in their closed position until the take-off valve is fully open.

I am aware that heretofore gas apparatus has been designed in which a number of valves have been so coupled as to move together in a determined manner. My invention, however, is distinguished from such construction in that I provide not for a simultaneous movement, but for absolutely locking one or more valves against movement when another valve or valves are in a determined position.

Domestic Illumination by Means of Gas.

[The first of a series of three Cantor lectures, delivered by Mr. Vivian B. Lewes, F.I.C., F.C.S., before the Society of Arts, London, England.]

The use of coal gas for domestic illumination is so important a factor in most of our households, that it might be expected that a fairly general knowledge would exist as to the principles upon which efficient illumination depends; and yet there are few subjects upon which cruder and more erroneous ideas are to be found, not only among the public, but even among many who are supposed to have made a special study of the questions involved.

When, about the middle of this century, the legislature began to attempt to safeguard consumers of gas, it was done by prescribing a certain standard of illuminating value to the gas, this being determined by the photometric methods then in vogue. This value was called the "illuminating power of the gas," and up to a few years ago it was looked upon by most people as expressing the amount of illumination to be procured in practice from the gas, and the illuminating power as obtained by photometrists from various burners as representing the illumination to be derived under ordinary circumstances from those burners. Both of these assumptions are incorrect, and have given rise to a chaotic bemuddlement in the theory and practice of illumination. During the past five years, it has been gradually realized by many that "illuminating power" and "illuminating effect" mean two totally different things. This apparent anomaly depends upon several distinct factors. In the first place, illuminating power or illuminating value is merely a technical method of expressing the ratio of light emitted by the combustion of a certain sample of gas as compared with the light of the standard candle, and has but little to do with the effect produced, when the gas is consumed under conditions differing from those under which it was tested.

The fact that this has not been universally recognized has arisen from the duty of the gas engineer ending with the distribution of his gas, while the methods of burning it have been entirely left to the gas fitter or the consumer; the result being that, while the former has looked upon the fulfilment of his statutory obligations as being the final object to be aimed at, the consumer, with the vaguest notions as to what the technical statement as to illuminating power means, has assumed that it represented the illuminating effect to be obtained from the gas. Indeed, where the consumer has taken the trouble to find out what is meant when he is told that he is supplied with 16 candle power gas, he learns that it means that, when the gas is burnt at the rate of 5 cubic feet per hour in the "London" Argand," it emits a light equal to 16 sperm candles, each consuming the sperm at the rate of 120 grains per hour. He, therefore, assumes that, by burning his gas at the rate of 5 cubic feet an hour in a "London" Argand, he gets the same illuminating effect in his room as if he had utilized the 16 sperm candles. Observation, however, would soon convince him that this is not by any means the case, and that, if he distributes his 16 sperm candles judiciously in his room, the illuminating effect produced is far superior to that of a London Argand burner emitting the same amount of light from a gas bracket in the center of the room.

This simple instance strikes the keynote of the difference which exists between illuminating power and illuminating effect. In the one case you have 16 centers of light, each illuminating a certain portion of the room, and none of them sufficiently intense to form a contrast with the others; while with the Argand burner emitting its 16 candles of light from one small cylinder of flame, you have an area of brightness in the center of the room, which throws the surrounding portions into comparative darkness, though they may be illuminated to an extent which without the brilliant contrast would appear to be sufficient and satisfactory.

Before discussing the question of the factors necessary to give satisfactory illumination, it will be well to glance at the photometric methods at present practically in use for measuring the illuminating value of gas. Many systems of doing this have been from time to time suggested; and from Francois Marie's attempt, in 1700, to measure the illuminating value of flames by trying how many pieces of glass had to be placed in the path of the rays in order to entirely cut them off, down to the present day, a large number of different expedients have been proposed. All the photometers, however, now practically in use for official gas testing date from 1843, when Bunsen first introduced the idea of measuring the relative intensities of light by equally illuminating the two sides of a piece of paper with a grease spot in the center, and then calculating the relative intensities by the distances at which the opposing sources of light had to be placed from the screen.

The principle of Bunsen's method of measuring the equality of light is that, if a portion of a sheet of paper be waxed, the part greased is more translucent to light than that which has not been so treated; and consequently, when a light is placed on one side of the paper, the greased portion stands out in a very marked manner as a bright spot on a dark ground. If now a second source of light be placed on the other side of the paper, the grease spot will appear bright on the side opposite to that on which the strongest light is placed. If, however, the two lights are so arranged that each side of the paper is equally illuminated, the spot will practically disappear, or the spots on the two sides will appear of the same brightness. The Bunsen disc made on this principle consists at the present time of a circle of ungreased paper in the center of a waxed disc. These discs are made by mounting them on a thin steel axle revolving at a high rate of speed. During rotation a vessel containing wax dissolved in a volatile solvent is brought in contact with them, and the paper is submerged in the liquid to a suitable depth, the result being that a small circle of paper remains unwaxed in the center of the disc. The excess of solution being removed, and the solvent allowed to volatilize, the discs are taken off the spindle, and are ready for use.

Besides the Bunsen disc with the plain circle, another variety, known as the "Leeson or "star" disc is sometimes employed. In this disc, two pieces of paper are fixed, one on either side of a thicker piece, out of the center of which a star-shaped figure has been cut. Difficulty was at first experienced with this disc, as the thin paper was apt to warp, and so present an uneven surface. This drawback was overcome by Mr. Dibdin, who fastened the papers together with thin starch water, and dried them under pressure; and in this way the warping and buckling of the paper was avoided.

The Bunsen disc has the disadvantage that, when two lights of different color are under trial, it is very difficult to find when the disc is equally illuminated. But the star disc does not possess this defect in so marked a degree; and lights of different tint can be compared with much greater ease.

A peculiarity sometimes met with, even in discs of the best construction, is that the sides give somewhat different readings; and consequently this may lead to the introduction of grave errors. If, however, during the tests, the disc is reversed, and half the readings made with it in each position, by taking the mean of the two sets of readings this error will be practically eliminated. If the discrepancy on reversing should be very great, the disc must be discarded; and in every case the surface of the disc in use must be protected from dust and dirt as much as possible, as the greasy surface is able to fix dust on it, and a new disc must be employed when the old one shows any sign of discoloration or irregularity in working.

After the introduction of the Bunsen disc, photometers began to be made in various forms. The first instrument consisted of an open bar 100 inches in length; and the disc was fixed in a frame which could be moved backwards and forwards. At one end of the bar the standard burner was placed; and at the other end was the candle. Dr. Letheby fitted the disc in a small box opened at the ends to the sources of light, an opening being made in the front to allow the observer to view the disc, which was placed in the center of the opening at right angles to the line of sight, and between mirrors placed at such an angle that the two sides of the disc could be seen at the same time by the observer standing in front of the box. In place of the single candle, two flames were employed; these being obtained from two halves of the same candle.

The candles used for testing gas, being moulded candles, are slightly taper, in order to facilitate their removal from the mould in which they are formed; and accordingly the quantity of sperm consumed as the candle burns will be constantly altering. If the candle be cut in half and lighted at the middle, one half will burn down to the thick end, while the other burns to the thinner end. Thus the differences in the diameter will be compensated for. The candles are suspended in a

holder on a small balance, so that the amount of sperm consumed during the testing can be accurately determined; and existing regulations only admit of those candles which consume more than 114 or less than 126 grains of sperm per hour as being "standard candles." The length of the bar was also reduced by Dr. Letheby from 100 to 60 inches, which may or may not be an advantage, according to the state of the atmosphere. On a 100-inch bar, the length of travel for the disc was considerably longer for an alteration of illumination than on a 60-inch bar, and for this reason the 100-inch bar was an advantage. But in foggy weather, or in an atmosphere containing a large amount of suspended matter, it is evident that the longer the bar the greater will be the interference of the atmosphere with the amount of light falling upon the disc. But if the standard and the light to be tested are nearly of the same value, the chance of error due to this source will be greatly reduced, in which case more accnrate determinations could be obtained from the 100-inch bar.

The "closed Evans" photometer was introduced in 1858. It consisted of a large box enclosing the candles and the light to be tested, and differed from the former open bar photometer in the disc being fixed, and the candles being mounted on the balance which traveled backwards and forwards by means of an endless cord attached to a small winch. This form of photometer was designed for open-air testing, and every precaution had to be taken against draughts affecting the candles or the gas flame. Its introduction into photometer rooms was a mistake, as the want of thorough ventilation and the heating effects of the walls of the box upon the larger flame, caused the results to be slightly in favor of the latter. This objection was, however, partly overcome by improving the ventilation at the two ends at which the candles and gas are burning, as is done in the "tower" photometer. But where a darkened room can be obtained, the open bar is undoubtedly the best, as the smallest check to the free passage of the air to the flame causes a slight increase in the products of combustion, and a corresponding influence upon the light emitted by the flame; and the tendency being to act upon the smaller flame more than upon the larger, the results cannot be relied upon.

The question of the standard light by which the value of coal gas is to be tested in the photometer has been so fully discussed before the Society within the present year that it seems hardly worth while to again go deeply into the matter. I will therefore only briefly indicate the propositions which have been made during the past 45 years, and the present state of our knowledge on the subject.

The candle has been recognized as the legal standard ever since its introduction by Bouguer as a unit of light. But the results which are obtained from it in practice do not in any way attain the scientific accuracy which ought to prevail; and while the standard does not yield accurate results, it is of little avail to try to attain perfection in the remaining portions of the apparatus used for testing the quality of the light. Wax candles were first enacted to be employed for gas testing in the year 1850, before which date there had been no definition as to what candles were to be used; but these gave way to sperm candles of six to the pound, and burning 120 grains of sperm each per hour. The light yielded by these candles was a little more than that obtained from the previous wax candles—14 sperm being equal to 16 wax candles. Pure spermaceti, owing to its crystalline character and consequent brittleness, could not be used alone in practice. Accordingly the sperm was mixed with 4 to 5 per cent. of beeswax; and great care has to be taken to get the quality of the sperm and the proportions of the mixture uniform. The wick is, however, the weakest point; a slight variation in the roughness or smoothness of the material, the preliminary treatment of the fiber, the twist of the thread or its tension during plaiting, causing great alterations in the light emitted by the candle.

All the various Committees appointed to consider the question of a reliable standard of light have unanimously come to the conclusion that the sperm candle cannot in any way be regarded as an accurate standard. Nevertheless, the candle holds its own as the legal unit of light, owing largely to its convenience, and the difficulty of providing another standard which shall be as handy to use and which will be more reliable under ordinary circumstances.

To obviate the inaccuracy of the sperm candle, many attempts have been made from time to time by the Metropolitan Gas Referees to insure more uniform results. The candle was first of all to be lighted at least ten minutes before the test was made, at the end of which time the wick was to have a glowing tip at the end of a slight bend, as when this condition is attained the candle will be burning at its normal rate. Later on it was prescribed that all testings were to be rejected in which the consumption of the sperm was more than 126 or less than 114 grains per hour. In 1889 the relative positions of the candles and their wicks were clearly defined, and the observer was further directed to employ a fresh candle for each test; while in September, 1894, minute regulations for securing, as far as possible, uniformity in the standard candles, by attention to the material and treatment of the wicks and sperm, were added to the Gas Referees' instructions. All candles issued for official gas testing in London are at present examined and certified for use by them.

In spite of these precautions, however, the candle still remains an unsatisfactory standard; and, in consequence, many other forms of standard have from time to time been suggested, among which may be mentioned the Keates lamp, introduced in 1869, which was practically a modified form of the moderator lamp. This lamp, when burning sperm oil at the rate of 925 grains per hour with a 2-inch flame yielded a light equal to 16 candles. This lamp was modified by Mr. Sugg, who added to it what was practically a Methven slot; and it gave more constant results than had been obtained from candles. But its general performances were not good enough to warrant its adoption. The French standard of light is the carcel lamp, dating from the year 1800. It burns refined colza oil at the rate of 42 grammes per hour; the light given equaling 9.5 English candles. The standard due to Herr Hefner-Alteneck consists of a lamp burning the vapor of amyl acetate, the wick being contained in a round German silver tube, 8 mm. in diameter and 25 mm. high, and so regulated as to produce a flame 40 mm. high. This lamp ought to yield a light equivalent to one candle; but Mr. Dibdin found that the flame had to be increased in order to equal the light which was emitted by the Methven screen. The red color of the flame, which renders the task of comparing the light to be tested a difficult one, is the great drawback to this standard. Another standard was proposed by Violle, but its impracticability rendered its use impossible, as he proposed to employ the light emitted by one square centimeter of platinum at the point of fusion.

The Methven screen, first introduced in 1878, is one of the most convenient forms of standard that have been proposed, and it is largely used in gas works at the present day. It consists of an upright metallic plate fixed in front of a "London" Argand burner. This plate has an orifice which is covered by a slotted silver plate, the opening in which is of such size that a quantity of light equal to that afforded by two average standard sperm candles is allowed to pass through when the gas flame is 3 inches in height. It is only within certain limits that one can get a constant light from a small portion of a gas flame; and though these limits are well within the illuminating value of the London gas supply, it is better to obtain greater constancy by using an aperture of smaller area, and carbureting the coal gas with pentane.

The standard proposed by Mr. Vernon Harcourt in 1877, and described at the meeting of the British Association in that year, was an entirely new departure. The burner consists of a brass tube, 4 inches in length and 1 inch in diameter; the upper end being closed by a brass plug, $\frac{1}{2}$ inch thick, in the center of which is a round hole, $\frac{1}{4}$ inch in diameter. Surrounding the tube is a glass cylinder 6 inch by 2 inch, the top of which is level with the top of the burner. At a height of 62.5 mm. above the burner is stretched a piece of platinum wire from 2 to 3 inches long, and about 0.6 mm. thick. The air which has been carbureted with the pentane is passed through a small meter, which registers one-sixth of a cubic foot at each revolution, and then through a governor, which regulates the supply to half a cubic foot per hour. The height of the flame is so adjusted that it appears to touch the platinum wire, but not to pass it; the platinum being fixed directly above the flame, and extending $\frac{1}{2}$ inch on either side of it. A special gas is used in this burner. It is made by mixing in a gasholder air and liquid pentane in the proportions of 1 cubic foot of air and 3 cubic inches of pentane. The latter is obtained from light petroleum, which is distilled at 60°, 55°, and twice at 50°C., and has to answer to the test of only faintly coloring 1-20th of its own bulk of fuming sulphuric acid on agitation with it for 5 minutes. The density of the liquid must be between 0.62 and 0.63 at 62° F.; it must volatilize at ordinary temperatures without leaving any residue when the tension of its vapor is not less than 7.5 inches of mercury; and its vapor density, as compared with air, must be not less than 2.47 or more than 2.53. The chief drawbacks to this standard are that the personal equation of the observer affects the unit of light to a considerable extent—it being difficult for two observers to fix the flame at the same height; while the flame is also largely affected by vibrations and draughts.

After all the endeavors to obtain a standard burner which shall emit a constant light of small intensity, the opinion is generally gaining ground that it is preferable to employ a standard light which shall nearly approximate to that yielded by the flame undergoing compari-

son. To meet this requirement, Mr. Dibdin has devised a 10-candle pentane Argand which consumes gas carbureted with pentane or a mixture of pentane vapor and air similar to that employed in the Harcourt unit. The Argand burner is of special construction, giving a very full-bodied flame, the top of which is cut off by a screen, exposing a fixed height of flame. This burner, from the constancy of the results obtained by its use, its ease of manipulation, and the small extent to which it is affected by external causes, is the standard recommended by the Photometric Committee of 1891–4; but its adoption in place of candles has not yet been effected.

Coal gas, during the testing of its illuminating value, has always to be burnt at a fixed rate of flow—5 cubic feet per hour. This acts very well within certain limits of illuminating power; but if the gas falls below 15½ candles, it has a very prejudicial effect on the results obtained. The height of the flame also is an important factor, as the size of the chimney is calculated to supply the correct amount of air for a 3-inch flame. If a shorter flame is being tested, combustion is overdone, with the result that a depreciated reading is obtained. If, however, the gas be richer, and the flame consequently longer, a false record will again be the result, as an insufficient supply of air is brought in contact with the flame.

It is evident from these considerations that both the photometers and the standards in use are capable of considerable improvement, while another source of error lies in the fundamental method upon which all such measurements depend. When the distance of the flame to be tested and of the standard have been so arranged that the disc is equally illuminated on both sides, the illuminating value is found by taking the ratio existing between the squares of the distances at which the light emitting sources have to be placed from the disc. The law of inverse squares, upon which this procedure is based, may be stated as follows: If the medium through which the light is passing is transparent, the intensity of illumination which a luminous point can produce on a white surface directly opposed to it is inversely as the square of the distance. It is manifest that this law will only be absolutely true when the source of light is a point; whereas in all photometric measurements the source of light to be measured consists of an area varying from 1 to 4 square inches in size, while the standard candle will give a far smaller area. At first sight, it appears as if this must be a grave source of error; but when the extent of the error comes to be mathematically calculated out, it is found to be excessively small as compared with the errors introduced by bad forms of photometers and faulty standards, as, while the standard and the light to be measured are at a reasonable distance from the screen, the error introduced by an extended area instead of a point is extremely small, and will not affect the accuracy of the results to any appreciable extent unless one or other source of light be brought within a distance of 7 inches from the screen. Directly, however, this limit is reached, the error increases with such enormous rapidity that the results obtained would have to be discarded. This is one reason why it would be far preferable to test a flame by a standard which, as nearly as possible, would approximate to it in size, as in this case the error due to this factor would disappear. This is a strong argument in favor of adopting the Dibdin 10-candle standard as the one by which the illuminating power of London coal gas, as determined in the "London" Argand, should be tested.

Attacks have from time to time been made upon the use of the law of inverse squares; but there is no doubt that, for all practical purposes, it may with safety be used photometrically, with the above reservations. It must, however, be apparent that, as the source of light is neither a point nor a uniformly illuminated surface, the amount of light emitted by a flame will probably vary considerably according to the angle at which the rays are falling. That this is so, was pointed out by Mr. Dibdin some years ago. It must also be borne in mind that the photometer only measures the relative intensity of the direct rays emitted by the flame—every precaution being taken to shut off reflected light; whereas, in the lighting of a room, the light thrown back from the walls and ceiling plays a very important part, and that reflected by the object on which it falls will also vary with the angle at which the rays strike that object.

The result of this is that, though the values recorded by the photometer give a ratio of value for the direct rays falling on surfaces in the same horizontal plane as the source of light, they tell us absolutely nothing as to the combined value of the direct and diffused light cast upon the book or any working surface, which, as a rule, will be at an angle varying from 45° to 90° below the flame. The direct rays are those which, radiated from the luminous source, fall directly on the object illuminated, whereas diffused light consists of those rays which have been reflected from one or more surfaces, or which have been refracted by passage through media of varying density. As photometry only deals with the primary source of illumination, and that, as a rule, only on the horizontal plane, it is absurd to suppose that such records of illuminating values can be worth anything as indications of the illuminating effect arrived at in practice.

The ordinary classes of burners in domestic use for the consumption of coal gas are the Argand, the flat flame, the regenerative, and the incandescent. The "London" Argand may be taken as the type of the first class; the union-jet and the batswing, of the second; the Wenham, Siemens, or "Cromartie," of the third; and the Welsbach and Sunlight mantles of the last. These burners have all been tested upon a radial photometer in a darkened room, in which all objects were carefully blackened so as to insure absorption of all rays not falling on the disc; and the following table records the results obtained:

TABLE I.—*Illuminating Value of Various Burners at Angles Below the Horizontal, in Terms of Candles per Cubic Foot* (16-*Candle Gas.*)

Angle, Degrees.	"London" Argand.	Union Jet. No. 5.	Union Jet. No. 7.	Batswing. No. 5.	Batswing. No. 7.	Regenerative	Incandescent.
Horizontal	3.20	1.67	2.09	1.90	2.43	3.4	16.6
10	3.19	1.62	2.08	1.84	2.42	4.8	16.6
20	3.07	1.55	2.03	1.73	2.38	5.3	16.1
30	2.72	1.45	1.88	1.61	2.25	5.8	11.1
40	2,38	1.40	1.64	1.47	2.18	6.0	8.8
45	2.18	1.30	1.50	1.38	2.12	6.2	8.0
50	2.12	1.27	1.50	1.38	2.05	6.5	6.6
60	1.20	1.23	1.50	1.30	2.07	6.7	2.0
70	*	1.23	1.37	1.23	2.00	7.7	*
80	*	0.76	1.25	0.76	1.75	8.0	*
90	*	0.30	0.87	0.76	1.37	8.0	*

* Unreadable.

In an ordinary dwelling room, the gas lights are, with few exceptions, so arranged as to be above the line of sight, so as to avoid irritating the eye. A moment's observation will convince anyone that the illumination shed upon one's book or writing is derived from a source from 40° to 90° above it; and it is manifestly the illumination given by the burner between these angles which is the important factor in domestic lighting. Turning to Table I., the marked inferiority of the standard "London" Argand at once becomes apparent, as at an angle of 60° it is surpassed in illuminating value by even the small flat flame burner; and the rule of thumb practice which has made this kind of burner the popular method of illumination is fully justified as long as we have only the flat flame and the Argand to choose between. When, however, we come to high power lights, such as the regenerative and the incandescent, we find that the latter, in spite of its overwhelming superiority in horizontal rays, is only equal to the regenerative when the working angle is reached; while below 60°, even the flat flame burners surpass it in illuminating value, and the regenerative burner shows itself, for the general lighting of a room, still superior to any of its compeers, as, with horizontal rays equal to the "London" Argand, it gradually gathers in illuminating strength the lower the angle becomes, until upon the table immediately below the burner a full flood of light is shed.

These results were obtained, as before mentioned, in a darkened room, the objects in which were blackened to prevent reflection; and therefore they represent the direct rays only, and allow nothing for reflection. It will be justly argued that, with such intensity of light as is given by the incandescent mantle, the reflections from the highly-lighted portions of the room would compensate for the loss of direct rays in the downward direction. In order to see how far this might be so, a fresh set of tests was made between the angles of 45° above and 45° below the horizontal—first in the darkened and blackened room, and immediately afterwards with the same mantle in a room with light distempered walls and white ceiling; care being taken to prevent light escaping into the room from the standard burner used. Under these conditions, the following results were obtained:

TABLE II.—*Candle Power per Cubic Foot of Gas.*

Angle. Deg.	With Blackened Ceiling and Walls.	With Light Ceiling and Walls.
45	8.75	11.23
40	9.72	11.80
35	11.28	13.26
30	12.25	14.90
25	13.22	15.01
20	13.60	15.30
15	14.58	15.53
10	14.97	15.71
5	14.97	16.13

Horizontal.....	14.97	.....	16.34
5	14.58	.....	16.34
10	13.60	.....	15.93
15	12.43	.....	14.30
20	11.28	.....	13.26
25	10.69	.....	12.60
30	9.72	.....	11.23
35	7.78	.....	10.21
40	6.22	.....	9.19
45	5.05	.....	8.60

In these experiments it will be noticed that the mantle used gave a slightly lower illuminating value than the one employed in the previous set; but as the same mantle served both in the darkened and in the normal room, the results obtained may be taken as a true indication of the effect due to reflection for this particular source of light, which, being exceptionally intense, gives a much larger percentage of general illumination from this cause than would be found to be the case with lights of less intensity.

It will be seen that, on the horizontal plane, the increased effect due to reflection is comparatively small, and only amounts to 9 per cent.; whereas at 45° above, reflection increases the illumination by 28 per cent., and in the downward direction the increase at 45° is no less than 70 per cent. This result, however, might be expected when one considers how much greater the reflective power of a white ceiling is than that of a boarded floor. The difference would, of course, be far greater with dark furniture and a carpeted floor, which would reduce to a minimum the reflection helping the upward rays, while the downward reflection would remain practically the same. With feeble sources of light in a fair-sized room, the increase of light due to reflection becomes almost negligible. On making an experiment with the "London" Argand burner under the same conditions as those used with the incandescent mantle, it was found that the increase given by the light walls and white ceiling was only 3 per cent. on the horizontal, and 1 per cent. at an angle of 45°. In practice, this trouble has to a great extent been met by the use of reflectors and globes of special construction, the results of which will be discussed in a future lecture.

It is evident from these experiments that, where the illumination is required for the table, the regenerative burner immediately above it gives by far the best results; while the flat flame burner is still the one best adapted for use in chandeliers. If, however, the general illumination of the room is aimed at, the incandescent mantle may be employed; but it must be attached to brackets on the walls of the room, and not be used in overhead chandeliers.

While admitting the usefulness of photometric observations on the horizontal plane, as giving a basis for legislative enactments as to the equality of an illuminating gas supplied to a town, I think the time has now arrived for a more general recognition of the fact that the values so obtained are useless for giving any indication of the light which a consumer may expect to develop from it. The so-called 16-candle coal gas supplied to London is made to yield on the horizontal plane anything from 8 to 80 candles of illumination, according to the burner used for its consumption; while at the angles ordinarily employed, startling modifications of these figures again take place. With most burners, the light afforded at an angle of 45° remains fairly constant up to an angle of 60°; and I think it would be a valuable step forward if, in comparing the light-emitting value of various burners, the light radiated at the working angle of 45° were always employed, instead of the misleading results obtained on the horizontal plane.

This is, in my opinion, one of the chief causes also of the discrepancies existing between illuminating power and illuminating effect. Other factors less easy to deal with are: (1) The difference in effect caused by the variations in the size of the source of light; (2) the effect of distribution and intensity of the sources of light on the visual organs; and (3) the reflecting power of the surrounding objects.

The size of the source of light has an important influence on the illuminating effect. If a large flat flame of coal gas and a small high power flame of oil gas or acetylene of the same illuminating value be placed at equal distances from a rod, and the shadow of the rod be then received on a white screen fixed at some distance from the rod, the shadow due to the large flame will be seen to have soft undefined edges, while that from the small flame will be sharp and hard; so that, though in each case the depth of shadow may be equal, the one will be far less striking to the eye than the other. This causes the illuminating effect of the large flame to be better than that given by the small one. Another important point is that the larger the surface from which the given amount of light is being emitted, the less will be its intensity for any specified area, and the less the deadening and irritating effect upon the optic nerve. The smaller and more intense the light-emitting source, the greater will be the contrast between the highly illuminated area immediately surrounding it and the less well illuminated parts of the room at a greater distance from it, which, to the eye fatigued by the intensity of the central illuminant, appear almost in darkness.

The best system of illumination for the living rooms of a house is undoubtedly to have the source of light so placed as to be well above the plane of vision, and yet sufficiently intense to flood the room with soft light; and it is the possibility of obtaining this with ventilating regenerative burners fixed in the ceiling that renders this mode of lighting at once the best and most healthful that can be used for dining and sitting rooms. It is, however, only the ventilating form of these lamps to which this applies. If a non-ventilating regenerative lamp is employed, it comes too far down into the room to be fit for use in any but an unusually lofty apartment, as, under ordinary circumstances, the heat thrown out is a serious drawback.

Where structural or other considerations prevent the use of ventilating lamps, the great aim in effective lighting should be to subdivide the source of light as far as possible. In the same way that 16 candles scattered about a room give a far more effective illumination than one 16-candle Argand burning in the center, so in a large space twenty 14-candle flames give a far better effect than ten 28-candle flames, and these latter again surpass one center of light equal to 280 candles.

If it is desired to use small and intense light centers such as incandescent mantles or acetylene flames, then, not only for illuminating effect, but also for the sake of the eyesight, we must adopt means for diffusing the intensity of the light source over a larger surface, which shall itself become the light emitting center. The means available for doing this will be discussed when we come to consider, in a subsequent lecture, the effect of various forms of globes in use.

Illuminating effect, not being due to any one factor acting alone, but to the combined effect of at least four, one or more of which will vary with the particular environment as well as with the source of light, can only be measured where it is produced; and no calculations can give even an approximation as to the result. Instruments for measuring the amount of illumination received at some given point have been devised by Preece, Mascart, Trotter, Sugg and others, and have yielded valuable data; but our knowledge is still too incomplete to allow of any very definite laws being laid down.

In the spring of this year some interesting experiments were made by Major G. K. Scott-Moncrieff, of the School of Military Engineering, Chatham, on the suitability of the various burners commonly in use for the illumination of the interiors of barracks and other buildings of a similar nature He took as a starting point the fact that it is possible to look up a train in "Bradshaw" with a light of 0.16 candle foot, provided the eyesight is good, and that therefore 0.2 candle foot is sufficient for any ordinary work of a character likely to be done after dark.

Experiments were then made in a soldiers' barrack room 40 feet long and 20 feet wide; and the source of light having been fixed 8 feet above the floor, the illumination on a horizontal plane 2 feet above the floor was determined by a specially constructed photometer. The height of 2 feet was fixed upon as being that of a man's knees when sitting on a chest or cot, and the lowest level at which printed matter would be read; and the area of the portion of room on that plane at which the illumination was 0.2 candle foot or higher was taken as satisfactorily illuminated. The practical results are shown in Table III., and the conclusions arrived at were—

1. That the present illumination by means of No. 5 Bray burners is wasteful of gas and inefficient as regards illumination.
2. For barrack room use, however, the common Bray burner may be retained, if used with caps, and grouped as in the Stott Thorp arrangement. This may in some cases be extravagant in gas, but the illumination is good, the arrangement is not easily damaged, and ventilation is assisted.
3. For reading rooms, sergeants' messes, officers' messes and other accessory buildings, the incandescent light is the best illuminant.
4. For places where the light source is situated some height above the floor—as, for example, in gymnasia, lecture halls and churches—regenerative lamps give very satisfactory results.

Every interior requires the illumination to be arranged for the special purposes in view. For the dining room, the illuminant must give a soft flood of light on the table, and yet be sufficient to light the sideboard and the floor space; in the workroom or the office a strong local light is required on the bench or the desk, and the remainder may be subdued light, while the sitting room calls for a uniform illumination that shall light up the pictures and cornices as well as the tables and floor.

TABLE III.—*Results of Experiments in the Illumination of a Barrack Room*

Name of Burner.	Total Gas Consumption per Hour. Cubic Feet.	Illumination.
Two Brays	16.0	Whole room insufficiently lighted. Nowhere possible to read small print 6 feet below gas lamp.
Two flat flame, fitted with caps	11.4	About one-fourth working space illuminated.
Two Stott-Thorp reflex lights	18.0	Eight-tenths of working level efficiently lighted.
Two Sugg workshop lights	16.0	About one-fourth working space efficiently lighted.
Siemens regenerative	11.0	Whole room well illuminated.
Deimel regenerative	9.0	Two-thirds of working space efficiently lighted.
Two Schulke lamps	10.0	Practically whole working space illuminated.
Welsbach incandescent with glazed conical reflector	4.3	Whole room brilliantly lighted.

In all cases the source of light should be well above the level of the eye. To my own taste, nothing can be better or more healthful for dining and living rooms than the ventilating regenerative burner; while as bracket lights, incandescent gas burners of a warm tint may be effectively employed. In bedrooms, man dare not dictate the form of illuminant; and the convenience of flat flame burners on brackets for heating curling irons will probably insure their supremacy. But whatever be the method of illumination, intense centers of light and harsh shadows should be avoided if you desire a proper illuminating effect.

Illuminating Power as Exhibited in the Parliamentary Returns.

[Read by MR. THOMAS NEWBIGGING, at the last meeting of the Manchester District Institution of Gas Engineers.]

Anyone perusing the yearly Parliamentary returns relating to gas undertakings in the United Kingdom, must be struck with the great differences which exist, in the majority of instances, between the *prescribed* illuminating power and the professed *actual* illuminating power of the gas supplied both by companies and by those local authorities who own the gas works in their respective towns.

I have been at some pains to look into the figures as regards this question of illuminating power exhibited in the returns, with a view to ascertaining the money value of the concession thus made to the gas consumer; and it may be interesting and instructive to you to have the result of my investigations. I have taken the latest returns—viz., those for 1894 for the companies, and to March, 1895, for the local authorities—for my text; and I have limited my inquiries to England and Wales.

The total number of statutory gas companies is 417; and of local authorities owning gas works, 157. The prescribed minimum illuminating power of the gas supplied by these is as follows:

Prescribed Illuminating Power.	Companies. Number.	Local Authorities. Number.	Total Number,
10 standard candles	6	—	6
12 " "	8	6	14
13 " "	2	—	2
14 " "	240	72	312
15 " "	123	39	162
15½ " "	2	—	2
16 " "	23	20	43
16½ " "	1	—	1
18 " "	3	5	8
20 " "	1	1	2
Not prescribed	8	14	22
Total	417	157	574

In order to insure that the illuminating power supplied shall be well up to the standard, and so avoid the risk of being penalized for default, the gas sent out must be somewhat higher in value than the prescribed rate—say, one candle in excess—though, as a matter of fact, a margin of from one-third to half a candle suffices for the gas companies of the metropolis, which are under regulations of the most stringent character. I have, however, assumed that the margin of excess may be put at one candle. For the purposes of my investigation, I have taken those works whose prescribed rates of illuminating power are 14, 15 and 16 candles respectively, as they represent the great bulk of the whole—viz., 517, out of a total of 574, or 90 per cent. Taking, therefore, these works, I find that the returns of the actual illuminating power supplied are as follows:

Table Showing Returns of Illuminating Power of Gas Supplied by Works having a Prescribed Rate of 14 *Standard Candles.*

	Illuminating Power.		
7 companies	14 candles.	3 local authorities.	
9 "	14½ "	—	"
1 "	14¾ "	—	"
24 "	15 "	3	"
1 "	15¼ "	—	"
41 "	15½ "	1	"
3 "	15¾ "	—	"
57 "	16 "	11	"
2 "	16¼ "	2	"
24 "	16½ "	2	"
— "	16¾ "	1	"
16 "	17 "	14	"
14 "	17½ "	10	"
1 "	17¾ "	1	"
16 "	18 "	10	"
5 "	18½ "	4	"
— "	18¾ "	1	"
4 "	19 "	—	"
— "	19¼ "	2	"
1 "	19½ "	3	"
— "	20 "	2	"
— "	20¼ "	1	"
14 "	not stated	1	"
Total.. 240 companies.		Total.. 72 local authorities.	

Together, 312.

Table Showing Returns of Illuminating Power of Gas Supplied by Works having a Prescribed Rate of 15 *Standard Candles.*

	Illuminating Power.		
1 company	14 82 candles.	— local authorities.	
8 companies	15 "	2	"
3 "	15¼ "	—	"
19 "	15½ "	2	"
4 "	15¾ "	—	"
20 "	16 "	5	"
2 "	16¼ "	1	"
13 "	16½ "	5	"
14 "	17 "	7	"
— "	17¼ "	2	"
11 "	17½ "	2	"
1 "	17¾ "	—	"
8 "	18 "	7	"
— "	18¼ "	1	"
2 "	18½ "	1	"
4 "	19 "	1	"
— "	20 "	2	"
13 "	not stated	1	"
Total.. 123 companies.		Total.. 39 local authorities.	

Together, 162.

Table Showing Returns of Illuminating Power of Gas Supplied by Works having a Prescribed Rate of 16 *Standard Candles.*

	Illuminating Power.		
4 companies	16 candles.	— local authorities.	
3 "	16½ "	1	"
4 "	17 "	—	"
2 "	17¼ "	1	"
2 "	17½ "	1	"
1 "	17¾ "	—	"
2 "	18 "	9	"
— "	18½ "	4	"
4 "	19 "	3	"
1 "	20 "	—	"
— "	not stated	1	"
Total.. 23 companies.		Total.. 20 local authorities.	

Together, 43.

Where fractional figures occur in the returns—as, for example, 0.2, 0.46. 0.82, 0.95—I have taken the average as near as possible, calling them ¼, ½, ¾, and 1 respectively.

It will be seen that the proportion of local authorities returning the higher illuminating values is greater than that of the companies. One company (in the 15-candle table) has, with an excess of candor, returned its illuminating power as being *below* the prescribed rate.

Eliminating from the foregoing lists the works whose actual illuminating power is at the prescribed, those which do not exceed the prescribed rates by more than 1 candle, and also those which have failed to make a return, I find the quantity of gas sold by the remainder in terms of 1 candle excess illuminating power (beyond the 1 candle margin) amounts to 18,005 million cubic feet for the companies, and 42,706 million cubic feet for the local authorities. This is made up as follows:

Cubic Feet, in Terms of 1 *Candle Excess beyond the* 1 *Candle Margin.*

	Companies.	Local Authorities.
14-candle prescribed.....	14,042,000,000	25,312,000,000
15 " "	2,750,000,000	10,895,000,000
16 " "	1,213,000,000	6,499,000,000
Total..... ..	18,005,000,000	42,706,000,000
Together,	60,711,000,000	

The enriching medium generally employed is cannel, though oil is also used to some extent. Assuming 1.6 cents per 1,000 cubic feet as the cost per candle of the excess illuminating power (always allowing 1 candle as the legitimate margin), this quantity for the companies amounts to $300,085, and for the local authorities to $711,765—together $1,011,850. If in my calculations half a candle only were taken by way of margin—as is found by the gas companies of the metropolis to be sufficient—the excess value given to consumers would be increased to over $1,500,000 per annum.

There will, no doubt, be differences of opinion as to whether the policy, so widely pursued, of giving such a high margin of illuminating value beyond the statutory figure is a wise one.

The varieties in the prescribed illuminating powers are curious, and their *raison d'être* inexplicable on any reasonable hypothesis. Why, for instance, should Liverpool and Southport be saddled with a 20 candle, and Salford, Wigan, Preston, and Middleton with an 18-candle standard respectively; while most other Lancashire towns have to be content with a 12, 14, or 16 candle standard? This want of uniformity is largely the result of caprice, and has no solid basis of reason to justify it.

Such striking differences exist, not only between the prescribed and the actual rates, but also in the illuminating power supplied in different towns in the same county. It is not apparent why there should be such differences. To take a few instances: Why should the consumers in Accrington have only 17-candle, and those in Ashton under-Lyne 19-candle gas? Croydon 15½ and Guildford 17? Stourbridge 15½ and Olbury 16½? Hebden Bridge 17½ and Sowerby Bridge 18½? Bingley 16½ and Batley 18? Hull 16 and Bridlington 17¾? Knottingley 15 and Longwood 18? Salisbury 15 and Swindon 17½? In a word, if 16-candle power, or a fraction over, is good enough for London, surely it ought to be good enough for (say) Tyldesleycum-Shakerley, where they profess to supply 18½-candle gas. There seems to be no kind of method in the madness of these variations.

It is to be presumed that the returns are *bonâ fide*. Whether the illuminating power in all cases has been determined by the standard photometer is more than doubtful. Probably the indications of the jet photometer have been adopted in many instances; and though this latter instrument is useful as affording a comparative test from day to day, it is by no means a trustworthy indicator of the absolute illuminating value, and should not be employed as such. Any manager of a gas works is badly advised in claiming the higher values given in the returns, unless he has the fullest justification afforded by the standard photometer for his doing so. It goes without saying that, with these high illuminating powers professed to be supplied (say) of 17 to 20 candle gas, a company, in making application to Parliament for increased powers, is (especially if opposed) placed at a serious disadvantage when the prescribed illuminating power is attacked; and a Parliamentary Committee can hardly be blamed if, under such circumstances, they raise the standard. That is tantamount to the company providing a rod to smite its own back. The engineer of such a company, when the prescribed rate is raised upon him, may be literally said to be hoist with his own petard; and he has thenceforward to groan under an intolerable burden.

That standards of 18, 19 and 20 candles are a grievous hardship, no engineer who has experience of them will deny. Such high qualities do not tend to lessen the number of complaints by consumers—on the contrary, they increase and aggravate them. Gas of this rich character is rarely burned to advantage; and unless it is, the inevitable blackening of the ceilings of rooms is attributed by the ordinary consumer to the foulness of the gas.

But what is to be thought of the promoters of a gas bill in Parliament voluntarily putting themselves under the yoke of an 18-candle standard? In the last session of Parliament, the local authority of a district, where the coal of such district does not yield gas of more than 16 candles value, actually undertook to give a minimum illuminating power of 18 candles! That their engineer advised this, I do not believe for one moment. They probably adopted the standard at their own instance. The proposal is due simply to a lack of knowledge of the existing conditions of illumination. Practically, it means 18½ or 19 candles. Gas of such high illuminating value, when burned under normal conditions, is an anachronism in these days of regenerative and incandescent gas lighting, when, by the adoption of a simple and comparatively inexpensive expedient, a 15 candle gas can be made to yield from 50 to 150 per cent. more light than formerly.

Absurdities of the kind to which I have alluded would give fit occasion for amusement were it not that the matter has a serious side, inasmuch as it tends to unsettle the minds of consumers, and to that extent is an injury to the gas industry.

Rustless Coatings for Iron and Steel.

[A paper read by Mr. M. P. Wood, at the December meeting of the American Society of Mechanical Engineers.]

The fourth paper on 'Rustless Coatings" was to have been devoted to the subject of oils and other vehicles used in paint processes. So many examples of the vagaries of corrosion of metallic bodies have presented themselves since the third paper was presented, which appear to claim the earnest consideration of engineers as to the causes and remedies therefor (the effects being in most cases too painfully apparent), that in lieu of the vehicle subject I present a case of corrosion of so remarkable a character, and one in which the record is so positive in its details, that it is removed from the category of speculation as to the cause of corrosion in this particular case.

How many more kindred cases could be brought forward of almost equal interest, if but reported for record by engineering observers, it is difficult to say; but the reported case of the corrosion of the floor beams of the old New York *Times* building, occurring, as it were, almost under one's feet in the short interval of 35 years, and in the hereinafter reported case of one of 6 days, appears to be an unanswerable argument of the dangers of using the oxide of iron in any form for the protection of metallic structures from corrosion.

This argument may be reinforced by the query, What is or what will be occurring to the metallic portions of the many sky scrapers that are in process of erection in our own and other cities at the present time, under great dissimilarity as regards temperature, humidity and other climatic conditions, but of one characteristic sameness—viz., being sealed in solid masonry or other coverings beyond the ken of inspection?

Inspection of these buildings now in progress, as well as those lately erected, reveals possibly a slight improvement in general over the conditions apparent two years ago; but the improvement is a hollow mockery, and will bear fruit for repentance ere many years have passed. These structures, though more carefully painted than those erected before with more and heavier coatings of some kind of stuff called paint, do not appear in a single case to have received any attention or consideration as to the condition of the metallic surfaces before applying the protective coating beyond a possible sweep with a dirty broom to get rid of the rough dirt from the workshop yard, and a possible wipe with a piece of old sacking to remove the grease due to machining processes. Anything like a washing down of the parts with soda ash or lye water to remove the grease, and then pickling with weak acid to remove the mill scale, and a subsequent washing with lime water to neutralize the acid bath, warming the work before painting it, and care to apply the paint only on clear, bright days, when no sweating can occur, or applying the paint in warm paint rooms. It is safe to say that not in a single case out of the many skeleton structures of our modern sky scrapers can this be found to have been the procedure. Not only this, but in the minor parts of the structure, where the light grillage and ornamental partitions should at least claim these precautionary measures to be used, and where the question of weight and complexity of parts could not arise to cause a decision on the side of cheap-john methods.

It is an indispensable condition, in applying paint for the protection

of metallic surfaces, that the surface must not only be first prepared by cleaning it to receive the paint, but the manner and time that the coating is applied are strong factors towards getting a favorable result. A poor paint properly applied to a properly prepared surface will in general give a better and more lasting result than a good paint improperly applied to an improperly prepared surface.

In previous papers on rustless coatings read before this Society attention has been called to a few of the many cases of destructive corrosion that are apparent to the most casual observer—viz., The Niagara Falls and Brooklyn Suspension Bridges (*Transactions* A. S. M. E., Vol XV., paper number 598, pp. 1044–1046); the Victoria Tubular Bridge across the St. Lawrence River at Montreal, Can. (Vol. XVI., paper number 626, p. 410), and the Firth of Forth Cantilever Bridge, Scotland (Vol. XVI., paper number 626, p. 407); the elevated railway and viaduct constructions of the Metropolitan railway lines in the city of New York, and the evidently wrong conception from the beginning of what was necessary for the protection from corrosion of these costly structures, so that their life could be measured by the lapse of centuries instead of decades.

The time is approaching when the new suspension bridges between New York City and Brooklyn—the North River bridge and the East River cantilever bridge, three of the most costly and important metallic structures of the many in the world—will require the most careful consideration by their engineer corps of the means to be taken to properly protect them from corrosion, as, aside from the comparatively unimportant quantity of the masonry used in their construction, the thousand of tons of steel that are embodied in them, divided and subdivided into thousands of separate parts, some accessible for examination as to their state at all times, but more that are so covered in when assembled as to utterly preclude any effective examination or the adoption of any protective methods other than those given at the time of their erection in place. The greater portion of the separate parts, large and small, that compose the whole structure will be comparatively unprotected during the greater part of the long years that they will be under construction, and subject to mechanical injury of whatever coating may be spread over them at the workshop, and also to those due to the varying changes in temperature and climatic conditions, aggravated by the presence of sea air, to which inland structures of the same class of design would not be subjected to, and whose complete failure from any cause would not be so disastrous as the partial failure of these.

The wires in the suspension cables of these structures (after having been freed from the mill scale of manufacture and drawing to wire) will no doubt be protected by some system of coating with zinc, tin, or nickel to properly cover in the screwed couplings used to join the separate wires, notwithstanding the fact that the electric welding of the wires would give a stronger connection at possibly the same expense. That screwed or twisted connections have always been used for this purpose may possibly prove too great a precedent to ignore. But why the persistent use of coating such wires with either boiled or raw linseed oil instead of a reliable carbon or plumbago paint it is hard to conjecture. Linseed oil free from pigment, applied to any metallic surface, absorbs moisture freely as a sponge, swells up, loosens its bond on the metal, and rarely if ever renews its bond when dried out. A properly prepared paint could be as readily applied as the oil, would take no longer to dry, and would resist friction and moisture greatly in excess of an oil coating, and be a proper foundation to receive the final protective coating ere the cables were finished or covered in.

Engineering, July 31, 1896, pp. 157–158, reports from a paper read by Mr. Hector Macoll, of Belfast, before the Institute of Mechanical Engineers (before referred to) an interesting case of the "Unusual Corrosion of Marine Machinery," due to the presence of oxide of iron pigment.

"Corrosion in marine engines and boilers is usually confined to well-known parts, is not rapid in its action, and may be prevented or stopped by the adoption of suitable measures. In a recent instance its action was so widespread, so rapid, and so powerful as to render a short description of it interesting to engineers."

Steamer.—The steamer "Glenarm" is a steel vessel of the long raised quarterdeck type, built in Belfast in 1890, for the Antrim Iron Ore Company, and is engaged in their trade between Belfast and ports on the north-east coasts of Scotland and England. She is classed 100 A1 in Lloyd's register, with a deadweight capacity of about 800 tons; and her machinery consists of three crank triple engines with cylinders 17-inch, 27-inch, and 44-inch in diameter by 30-inch stroke, a three-furnace, single-ended boiler of the usual type, loaded to a pressure of 165 pounds per square inch, and a single furnace, horizontal, multitubular donkey boiler. The shafting and other forgings are all of iron; the boilers are of steel, with iron tubes.

Submergence.—On Tuesday, December 24, 1895, this steamer carrying a cargo of about 650 tons of "burnt ore" from Irvine to the Tyne, struck on a rock in the Sound of Mull, and was at once beached in Scallaster Bay, where the sea stood a little over her after-deck at low water, and close up to her bridge deck at high water. On the following Monday, December 30, after having been submerged six days, she was pumped out and raised. On the same day steam was got up in the main boiler; but when about 30 pounds pressure had been reached, the steam valve on the donkey pump blew out, and it was found that the copper at the bend of the donkey feed-pipe next the main boiler had disappeared; fires were therefore drawn, and the boiler blown off. On Friday, January 30, 1896, all leaks having been so far reduced as to be under control of the salvage pumps, the vessel left in a tow for Belfast, where she arrived early on Saturday morning, all the salvage operations having been successfully conducted by Captain Bachelor, of the Liverpool Salvage Association.

Cause of Corrosion—On examination, the machinery was found to present an extraordinary appearance; all wrought iron work was deeply and roughly corroded, and planed cast iron work rendered so soft as to be easily cut with a knife. These unusual effects were undoubtedly caused by the cargo of "burnt ore," and the following explanation has been contributed by Mr. S. Courtney, chemist, of Messrs. Francis Ritchie & Sons, Belfast, who investigated the subject at the request of Mr. Browne, Secretary and Manager of the Antrim Iron Ore Company: "Burnt ore is the residue from the manufacture of vitriol from sulphur pyrites, and is generally found to contain about 4 per cent. of sulphate of copper, together with a little sulphate of iron due to the sulphur not having been completely burnt out of the ore and becoming oxidized into sulphates. The sulphate of copper would be more or less completely dissolved in sea water, and as the latter contains a considerable quantity of chloride of sodium, or common salt, this would react on the sulphate of copper, forming sulphate of sodium and chloride of copper. The sulphate of copper and chloride of copper are both soluble in water, and a solution of either or both dissolves wrought iron and cast iron. The chloride is more energetic in its action than the sulphate; but in time a solution of either, no matter how weak, will dissolve an atom of iron for every atom of copper present. Every 100 tons of cargo contained as much sulphate of copper as would, if available, dissolve nearly 32 cwt. of metallic iron. The burnt ore might also contain a small quantity of free sulphuric acid, which would combine with the soda of common salt in the sea-water and set free hydrochloric acid, and the latter would rapidly act upon copper or brass."

Extent of Corrosion.—On the condition of affairs being discovered, the engines and boilers, as well as the hull, were at once opened up for survey, the underwriters being represented Mr. H. H. West, of Liverpool, and the owners by Mr. James Maxton, of Belfast. The entire work on the hull and machinery was afterwards carried out under the direction of the latter. The general condition of the engines was that wrought iron work had been penetrated by corrosion to a depth of about three-thirty-second inches, and planed cast iron so softened that one-eighth inch had to be taken off before a hard surface was regained. Surfaces in bearing contact, or with oil between them, and all painted surfaces, were completely preserved. The detailed condition of the various parts and the measures taken to restore them were as follows:

Cylinders.—These had partially filled through the hot well, and from the drain cocks being open. The lower part of the intermediate cylinder was softened for 12 inches up, and was rebored one quarter inch larger in diameter, and the piston altered to suit. The piston valves and liners in the high-pressure and intermediate cylinders were softened at their lower ends; the liners were rebored, and the valves fitted with new rings. The lower edges of the the low-pressure slide valve and face were also softened; the valve was planed, and the lower bar of the face chipped off and replaced by a brass strip pinned on. In all other respects they were sound and good.

Piston rods and connecting rods were turned all over, reduced three-sixteenths inch in diameter, and the former fitted with new neck and gland brushes.

Guides had one-eigth inch planed off them before a hard surface was reached; and the guide shoes were lined up to suit.

Valve gear is of the Hackworth type. The valve spindles and various rods were turned all over, to remove the deep pitting; the angle blocks had their planed surfaces reduced one-eighth inch, and the various parts lined up to suit.

Shafting.—The crank webs were deeply corroded, but as there was ample strength they were filled with "hard stopping" and painted.

The shaft journals and crank pins were pitted longitudinally in the exposed spaces between the white metal strips, and were also pitted transversely at the clearance spaces next the crank webs; these were cleaned out, filed up, and the bearings adjusted. The thrust shaft was much corroded at the exposed parts of the collars and journal; it was turned all over, and the horseshoes and bearing were refilled with white metal. The intermediate length of tunnel shafting was much corroded at the exposed part of the journal, and as it was also reduced by wear, a new journal was turned further forward, and the bearing shifted to suit. The propeller and propeller shaft were found in good order.

Auxiliaries.—The centrifugal pumping engine was considerably wasted in the rods, guides, etc., and was treated like the main engines. The duplex pumping engine and donkey boiler pump were so seriously corroded as to be useless, and they were replaced by new. The brass steam valve and one pet cock of the duplex pumping engine were curiously wasted into holes, and the check valve and seat on the main boiler had the appearance of some substance, probably zinc, having been sucked out of them.

Pipes.—From the appearance of the donkey copper feed pipe it was feared that all the copper pipes were seriously affected. A similar bend in the main feed pipe was therefore sawn through, but was found to have suffered no deterioration. All the pressure pipes, however, were taken down, tested and annealed; no defects were detected, and they were all replaced. But in putting together the various steam and vacuum gauges the small connecting pipes were found in several places to be curiously wasted below the coupling nut.

Small Details.—It is unnecessary to enumerate the bolts, nuts, cock handles, spanners, and such small details, which were wasted into mere shadows of their former selves, and had to be renewed.

Boilers.—The safety valves of the main boiler having been eased when the vessel was beached, the boiler had filled with water; and the condition of both boilers looked serious. The front end plate of the main boiler was considerably wasted; the furnaces, which are of the spiral, corrugated type, had corrosive scores running in the direction of the corrugations; and the tubes were covered with a deposit of what appeared to be pure metallic copper. In the end, however, after careful drilling and gauging, it was found that an unexhausted margin remained in all except the tubes. These were all found to be seriously corroded in both boilers, and every tube was therefore cut out and renewed; after which the boilers were satisfactorily tested.

Steam Trial.—Although the utmost vigilance and care had been exercised in examining as far as possible every point and detail, latent defects might have existed, and it was not with complete confidence that steam was again raised and the machinery tried. Neither then, however, nor in the months of continuous service which have since elapsed, has the slightest defect been perceived; and the machinery is now, thanks to its thorough overhaul, working with the efficiency and economy which it possessed when new.

Conclusions.—The lessons to be learnt from this experience are probably obvious enough. Some of them are for the shipowner rather than the engineer, and therefore need hardly be referred to here; but it may be well to emphasize two of the others.

First, the advantage of having in marine engines and boilers a small margin over the actual requirements for strength. In the various rods, shafts, and similar parts, such a diameter as would allow them to be skimmed up; in the cylinders, valves, etc., such thickness as would allow them to be bored or planed afresh; and in the furnaces, combustion chambers, and stays, a slight excess of thickness over that required by the rules.

Second, the advantage of good paint. Many engineers prefer polish to paint, but in this instance the latter truly cost little and was worth much.

The final paragraphs may well claim serious attention. The cause and effect are so closely related that all doubts as to the cause are set at rest. As stated in previous papers read before this Society, the corrosive agent is found in the oxide of iron pigment as usually prepared for the market, and claiming great superiority as to quality by reason of its bright attractive color and purity over other forms of oxide pigments ground from hematite ores, whose dirty brown purplish color indicates the presence of more or less clay and earthly matters, wholly unreliable as a pigment even when mixed with good linseed oil, and whose varying qualities are readily detected in the separate consignments from the same manufacturer or compared with each other. Of the samples from the many concerns turning out this Cheap John material, none are good, all are bad and comparatively useless for the protection of metal, however admirably adapted by virtue of their cheapness to wooden structures, and are a poor investment for them if the merits of a better paint is considered.

How much damage is done to the internal parts of a marine vessel by the use of iron oxide paints with which those portions below water mark in the holds are usually coated it is hard to realize. Bilge water is a very corrosive fluid, composed as it is of sea water mixed with the leakage from fluid cargoes soured by the heat of the hold, the sulphur water from the furnace, ashes and pyrites in the coal bunkers, mill scale and paint oxides of copper and iron thrown down in the course of repairs to boilers and hull and seldom if ever removed, continually agitated and washed over the exposed metallic surfaces, and aided by the presence of carbonic acid generated from the conglomerate mass in the confined air of the hold. It is scarcely to be wondered at that the vessel when in the dry dock for the too often extended yearly examination is found in such an advanced stage of corrosion that it is necessary to cut out and renew frames, bulkheads and other parts so corroded as to endanger the safety of the ship in seaway. The engineer in charge in the due performance of his duties will attend to the repairs, but the ship owner who pays the bill when approached with the question, "What shall we coat her with to prevent this occurring again?" too often cannot see *his way* out of the dilemma, and says, "Give her the old stuff, and let her go."

In the discussion following the presentation of the second paper on Rustless Coatings, read before this Society (*Transactions A. S. M. E.*, Vol. XVI., paper number 626, p. 416), Mr. F. H. Boyer (member) cited the case of 1,800 feet of 12-inch cast iron pipe, laid 2½ years and used to pump sea water, that had changed in its entire length to plumbago, and could be readily cut with a knife, and would have to be renewed as a whole. Possibly the presence near the inlet of the pipe of some acid manufacture or waste pipe from it, or some sunken cargo of iron oxide may have contributed to this decay. Pure sea water is strongly corrosive, but not alike in its effect in all parts of the world; it is, however, stronger in its corrosive effect when mixed with sewage water, and this may have been one factor in the case. Mr. Boyer will confer a favor upon the engineering fraternity if he will give the results of his later examinations as to this case. Such records are of extreme value.

The Sources of Error in Mine Surveys.

Mr. W. A. Engard, in a communication to the *Colliery Engineer*, says that electricity is being used so much in mining operations that it is very important that every mining engineer and surveyor should be made acquainted with the result of some very recent experiments on the effect of electric currents on delicate instruments. In the Westphalian coal fields electric railways are rapidly on the increase, and the question arose whether the electric currents exercised any detrimental action upon the magnetic mine surveying instruments which are used so largely in the German mines.

In order to determine this, Prof. Lenz selected a point underground at a horizontal distance of about 100 yards from the rails of an electric railway, and 1,420 feet below it. Then by means of a magnetometer, with quartz fiber suspension, a series of observations of variation were made, based on a fixed line. The day curve was very irregular, while the night results displayed perfect regularity, and were quite in accord with the magnetic records.

This exhibited that magnetic observations can, under such conditions, be only satisfactorily conducted during the night, in the absence of the magnetic current. Another source of error is the safety lamp. Composed of various metals, the lamp in a hot condition sets up thermo-electric currents which act on the magnetic needle.

In order to obtain information on this point, six mine surveyor's safety lamps, free from iron, were placed one at a time, first in a cold condition and then heated, at a pole of a sensitive magnetometer. Of the six lamps, two, when cold, had no action on the needle, while all acted on it when hot. The deviations observed amounted to from 30 seconds to 100 seconds.

A new benzine lamp, that had not been previously used, caused a deviation of as much as 5 minutes. The deviation increased with the temperature of the lamp. A new aluminum safety lamp caused the same deviation when cold as when hot. From these results it follows that the mine surveyor, before making magnetic observations with delicate instruments, should carefully test his lamp. The influence of slight magnetic properties may be lessened by holding the light in the prolongation of the magnetic axis. With side lighting great care is necessary. It is thus demonstrated that the mining engineer and surveyor should make their observations at night. If they carry out that operation during the daytime in the neighborhood of an electric plant, etc., the results are almost certain to be wrong, and trouble will ensue.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

WE understand that Mr. R. G. Dawes, of Lincoln, Neb., has secured a controlling interest in the Newark (O.) Gas Light and Coke Company.

A HINT from Lynn, Mass., is to the effect that Mr. Carroll S. Knapp, for some time in charge of the works of the Marblehead (Mass.) Gas and Electric Light Company, will retire from the Company's service January 1st.

MESSRS. EDWARD RIDGELY and John H. Ruckle, of Springfield, Ills., recently inspected the plant of the Decatur (Ills.) Gas Light and Coke Company, with a view, it is said, to purchasing that property. Mr. Ridgely is well known in gas circles through his large interests in the Springfield (Ills.) Company.

AT the annual meeting of the Lancaster (Pa.) Gas Light and Fuel Company the following Directors were elected: John I. Hartman, H. C. Demuth, J. C. Hager, W. U. Hensel, D. McMullen, H. M. North, George R. Rohrer, John D. Skiles, J. F. Semer, P. B. Shaw, H. S. Williamson, P. T. Watt, J. G. Zook, J. H. Baumgardner and N. M. Woods. Subsequently the Directors perfected the following organization: President, John I. Hartman; Secretary, John H. Baumgardner; Treasurer, John C. Carter. These officers also control the affairs of the Lancaster Edison Electric Illuminating Company.

THE proprietors of the Ilion and Mohawk (N. Y.) Gas Light Company have determined to increase the capital stock of that corporation from $30,000 to $50,000.

ON and after January 1st next the net rate for gas supplied by the Companies popularly claimed to compose what has been known as the "Chicago Gas Trust" will be $1 per 1,000 cubic feet. This concession is made under the terms of the agreement, signed June 17th, 1891, by the then Mayor of Chicago (Mr. Washburne) on behalf of the city, and by the executive officers of the following Companies on behalf of the named corporations: Chicago Gas Light and Coke Company, Consumers Gas Company, Equitable Gas Light and Fuel Company, the Suburban Gas Company, the Hyde Park Gas Company, and the Lake Gas Company. The main provision of that agreement is here repeated:

"*First.*—That the several Gas Companies above mentioned do covenant and agree with the city of Chicago that so long as they respectively supply gas to private consumers within the city of Chicago the price of gas furnished for illuminating purposes to private consumers shall not exceed the net price next hereafter mentioned for 1,000 cubic feet of gas of 24 candle power—that is to say, until the 1st day of January, 1893, such net price shall not exceed the net price of $1.25 per 1,000 cubic feet; that during the year 1893 the net price shall not exceed $1.20 per 1,000 cubic feet; that during the year 1894 the net price shall not exceed $1.15 per 1,000 cubic feet; during the year 1895 the net price shall not exceed $1.10 per 1,000 cubic feet; during the year 1896 the net price of gas shall not exceed $1.05 per 1,000 cubic feet; during the year 1897 and thereafter the net price shall not exceed $1 per 1,000 cubic feet, said price to be the maximum net price to consumers for and during the periods above mentioned respectively. Said Companies may, however, charge 25 cents per 1,000 cubic feet in excess of said net price, with a rebate of said excess upon bills paid on or before the 12th day of the preceding month." The agreement also specified that gas should be supplied to the public buildings of Chicago at the rate of $1 per 1,000, and that contracts for street lamp supply should be made annually.

THE contract for the steel trusses and covering for the extension to the retort house of the New Britain (Conn.) Gas Light Company has been let to the Berlin Iron Bridge Company, of East Berlin, Conn. This roof is to be supported on steel trusses, and the covering is to be of corrugated iron, lined with the Berlin Company's patent anti-condensation roof lining.

THE retort equipment for the plant of the Consolidated Gas Company, of Davenport, Ia., is being furnished by the Laclede Firebrick Manufacturing Company, of St. Louis, Mo.

THE residents of the town of Pullman, Ills., are declaiming bitterly against the gas rates there—$2.25 per 1,000 for an illuminating supply, and $1.75 per 1,000 on fuel account. The works are owned and operated by the Pullman Company.

THE Board of Gas and Electric Light Commissioners, of Massachusetts, will be applied to by the Edison Electric Illuminating Company, of Boston, for an approval of a proposed issue of new stock amounting to the par value of $500,000.

THE Aldermen of Houston, Texas, seem averse to granting the franchise for a fuel gas concern, recently asked for by certain speculators who are non-residents of that city.

ANOTHER instance of the gas inspector and political reversals is at hand from San Francisco. For some time the position of gas inspector for that city has been acceptably filled by Mr. C. E. Newman, but at the recent election there a set of officials of a different political faith from those that heretofore governed local affairs in San Francisco came into power. The gas inspector's place was wanted for some one of the lucky faithful, and it has been decreed that Mr. Newman must go. There is no charge that he is incompetent. At the time of writing it seems that Supervisor C. L. Taylor is most likely to succeed Mr. Newman, although there are several other candidates for the position.

AT the recent municipal election in Taunton, Mass., one of the questions submitted to the voters was whether or not the city should engage in the operation on municipal account of an electric lighting plant. The total number of votes cast was 3,712, of which 1,952 were in favor of the scheme, while 1,760 opposed it. There are 12 voting districts in the city, 5 of which voted adversely on the proposition.

THE franchise originally granted to the E. J. Acker Construction Company for the right to build and operate a gas and electric light plant in Norfolk, Va., expired by limitation on the 11th inst.

THE new proprietors of the New London (Conn.) Gas Light Company are showing the right sort of action in respect to the development of the gas possibilities of that city. The active man at New London just now is Mr. A. J. Purinton, who is known to the gas men of Connecticut from his connection with the Stamford Gas and Electric Company. Next spring the New London works are to be remodeled almost to the point of being rebuilt, and the main system, which, aside from its inefficiency in the instance of reaching so small a proportion of the residential districts of the city, is in poor physical condition, is to be overhauled and extended. Our correspondent adds: "The Company will at once open an office in the central portion of the city, a move that will be greatly appreciated by those who have business relations with it. The office quarters will also include a showroom for the display of gas burners, cookers, heaters, etc., for it is the purpose of the present owners to push the use of gas in directions other than that of illuminating only. A sensible reduction in the selling rates will also be made.—OBSERVER."

MR. ELLIOT A. KEBLER, formerly Secretary of the Addyston Pipe and Steel Company, of Cincinnati, Ohio, has accepted the position of Resident Agent, with headquarters at 52 Ninth street, Pittsburgh, Pa., of the pig iron firm of Messrs. Matthew Addy & Co., of Cincinnati.

A CORRESPONDENT, writing under date of Monday last, says: "I read your curt reference, in your issue dated to-day, to the proposed new gas and electric light company for Saratoga Springs, N. Y. In refutation thereof let me say that the 'malcontents' are well beyond the 'speechmaking stage' regarding the projected company; for the concern has been organized under the title of the Home Gas, Electric Light and Power Company, and a site for the plant has been chosen, on the line of the Fitchburg Railroad." We are sorry to have disturbed our correspondent, but we beg leave to say that there is much difference between choosing a site and paying for it.

THE office headquarters of Mr. James Gardner, Jr., have been removed from the Conestoga Building, Wood and Water streets, Pittsburgh, Pa., to the Hamilton Building, Fifth avenue, same city.

AT the annual meeting of the Carondelet Gas Light Company, which property is controlled by the Laclede Gas Light Company, of St. Louis, Mo., the following Directors were elected for a term of two years: Geo. A. Madill, Henry C. Scott, Alexander Ross and John Scullen.

THE Albo-Carbon Light Company has filed articles of incorporation, and also a declaration of its purpose to engage in "the manufacture and sale of lighting materials and fixtures in Newark, N. J., and elsewhere." The headquarters of the concern will be in Newark; it is capitalized in $250,000, and the incorporators are: James Kidd and

Chas. W. Boylen, of South Orange, N. J., and Frank J. French, of New York.

THE Maryland Meter and Manufacturing Company has retained Mr. S. S. Stratton to represent it as a salesman.

A CORRESPONDENT forwards the following under date of the 15th inst.: "The Englewood (N. J.) Electric Light Company has commenced to supply electric current to its customers, having arranged with the Hackensack (N. J.) Gas and Electric Light Company for its supply. The distance over which the current is transmitted is about six miles, crossing under the Hackensack river by cable, and thence across the 'flats,' through Leonia and Nordhoff, to Englewood. The Englewood Electric Light Company is controlled by the Bergen County Gas Light Company, so that the latter is now in position to give its patrons their choice between gas and electric lights. The Superintendent of both Companies is Mr. Samuel F. Gold, who has had charge of the Bergen County Gas Light Company for the past 25 years."

THE Houston (Texas) City Council some time ago adopted a resolution directing the City Attorney to search the records for the franchise under which the Houston Gas Light Company operates. The Attorney subsequently reported that the records disclosed the following grant: "Gas Light Company: Permission is hereby granted the Houston Gas Light Company to erect their works and lay their pipes within the limits of the city, the Council reserving the right of controlling the location of the gasometer.—Passed December 6, 1866"

THE new plant for the Columbus (Ohio) Gas Company is to be located on a plot of land on the east bank of the Olentangy river, directly north of the Pan Handle Railroad. The plot, which covers about 10 acres, was formerly the site of the works of the Columbus Rolling Mill Company. The manufacturing plant proper, we understand, will not be constructed until 1898, but next spring work will be commenced on the construction of a holder, rated to store 2,000,000 cubic feet. During the same season a 24-inch main will be laid to connect this holder with the Company's existing main system.

NEW YORK people are considering the advisability of constructing and operating a gas plant in Dover, N. J. At present the township, which is said to have a population of 7,000—the village itself has a population of 3,400—is lighted by means of incandescent electric lamps.

THE Spanish-American Light and Power Company, which controls the gas supply of Havana, Cuba, is experiencing considerable trouble in making collections, which will readily be understood when it is said that the money owed to it on public lighting account by the city of Havana amounts to $300,000. Mr. Benjamin Giberga, who had acted for some time as Treasurer of the Company, resigned that position on the 1st inst.

MR. C. S. WORTLEY, Secretary of the Ypsilanti (Mich.) Gas Company, gives notice that the annual meeting of the Company will be held in the First National Bank, Ypsilanti, at 7 P.M., Jan. 11th.

THE new electric station of the Amherst (Mass.) Gas and Electric Light Company is in satisfactory working order.

THE Kansas City (Mo.) *Star* says: "Notwithstanding the denials by gas officials, there are indications that Kansas City will soon have only one Gas Company, and that the price of gas will be the uniform legal rate of $1."

COL. PAYNE, President of the Kansas City Gas Company, in the same issue of the *Star* in which the above was printed, denies in positive terms that any consolidation of that Company with the Missouri Gas Company is contemplated.

UNDER the bid of the Erie (Pa.) Gas Company, in response to the proposition of the local authorities for tenders for the lighting of the streets of that city, the figure submitted was: $21.50 per lamp per year, either for 1 or 5-year contract. In case the number of lamps required exceeded 700, the price was to be $20.50 per lamp per annum. The schedule calls for service every night and all night. Last year the gas lamps in use numbered 513.

A CORRESPONDENT forwards the following under date of the 14th inst.: "A meeting of the stockholders of the Chicopee (Mass.) Gas Company was held on the 11th inst., at which it was voted to sell the entire plant to a New York syndicate, which was represented at the meeting by Mr. H. A. Odell, of New York. The purchasers will assume control January 1st, and Mr. C. H. Nutting, who has been Superintendent and Treasurer of the local Company for the past two years, will be retained. The new owners of the plant will make many improvements in the service. During the first year they intend to lay out $20,000 in extending the mains, and a like amount during the subsequent year. The scheme includes a line of pipe to Chicopee Falls. The Chicopee Manufacturing Company, which has supplied gas to the Falls for several years, more as an accommodation to the residents than as a money making project, will then cease the manufacture of gas, a business that it originally undertook for the purpose of supplying its huge mills with light."

THE rates charged for gas in Salt Lake City, Utah, have been receiving much attention from the City Council, which body claims that the rates are excessive. The Council desired to pass an ordinance revising the Company's schedule, but as doubt existed as to whether the Company's charter was of a nature precluding the interference of the Council with the prices the Company might charge, the matter was referred to the City Attorney for an opinion as to the powers of the Council in the premises. The results of the Attorney's examination of the question are appended:

"Gentlemen: I have the honor to acknowledge receipt of the Recorder's communication of December 3, 1896, in which I am instructed to investigate and report to the Council whether, in my judgment, it has the power and authority to regulate the price to be charged for the sale of artificial or manufactured gas; and, in the event I am of the opinion that such power is vested in the Council, that an ordinance be submitted, fixing a price on all such gas of $—— per 1,000 cubic feet, or any fraction thereof, used in any one calendar month. In reply, I have to state that in my opinion the Council has ample power to fix the price to be charged for the sale of gas used in this city. This authority is granted by Section 109, of Article 4, of an act approved March 4, 1888, in relation to the power of City Councils in this State, which reads as follows: 'To provide for the lighting of streets, laying down of gas pipes, and erection of lamp posts, and to regulate the sale and use of gas and electric or other lights, the charge therefor, and the rent of gas meters within the city, and to regulate the inspection thereof, to prohibit or regulate the erection of telegraph, telephone or electric wire poles in the public grounds, streets or alleys, and the placing of wires thereon, and require the removal from the public grounds, streets or alleys of any or all such poles, and the placing underground of any or all telegraph, telephone, or electric wire poles in the public grounds, streets or alleys of any or all telegraph, telephone or electric wires.' I have, therefore, in accordance with your request, drawn a bill for an ordinance to fix the price to be charged for manufactured gas in this city, and inclose the same herewith for your consideration. In submitting this ordinance you will pardon the following suggestions, which in my judgment should be considered by the Council before taking final action in this matter.

"(1.) That the power granted to the Council to fix the price of the service rendered by the franchise companies to the municipality and its inhabitants after a franchise has been granted, is one that must be exercised with extreme care.

"(2.) There is a well-defined limitation upon this power, namely: That the price to be fixed shall be a reasonable compensation for the service performed.

"(3.) A compensation that will not cover the necessary expenses and a reasonable profit is not reasonable.

"(4.) An enforced compensation that is not sufficient for these purposes is not favored by the courts.

"(5.) The determination of a reasonable price is in this case a judicial as well as a legislative act, and should only be passed upon after full investigation and with access to such facts as are necessary to arrive at a correct conclusion."

Air in the London Underground Railway.

The *Scientific American* says that analysis showed that the amount of oxygen in some air taken between Gower street and King's Cross [London] was only 20.60 per 100 parts by volume, while in the worst courts of London it was never found lower than 20.86, says *Health News*. Pure air contains 20.94 per cent. of oxygen. And with diminution of oxygen there was a proportionate increase of carbonic acid gas. The normal quantity is 0.037 in 100 parts, but Dr. Angus Smith (whose analysis we are quoting) found that in one of the Metropolitan Railway tunnels the carbonic acid gas was 0.388 per cent.; this is excessively high when we take into consideration Prof. Pettenkofer's assertion that whenever the carbonic gas in the atmosphere exceeds 0.100 per cent. the air is too much polluted to be breathed with safety to health

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,

PROPRIETORS.

EDITOR——————

ASST. EDITOR—T. J. Cunningham.

MANAGER—C. E. Sanderson.

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MONDAY, DEC. 21, 1896.

The Market for Gas Securities.

All city gas shares are weak and lower, which result is the natural outcome of the recent doings in the Board of Aldermen and the belief that the next Legislature will be disposed to make trouble for the Companies in the large cities. The Consumers fuel gas scheme is to all intent dead, the franchise having been recalled from the Mayor by the Board, who referred it to a committee, where it slumbers. Consolidated sold to-day (Friday) at 150. Some of the economies in the truce over the canvassing for consumers by the local Companies were put in effect this week.

Brooklyn Union gas shared in the depression of values, and it is likely that a contract under the Wray bill, naming gas prices to rule in Brooklyn for a period of years, both on public and private use account, will be made prior to the assembling of the Legislature. Chicago gas is dull and weak owing to the peculiar adverse conditions affecting the general share market. Bay State holds its own, and we still hold the belief that the shares are cheap at the market. At auction this week: 13 shares Municipal Gas Company, of Yonkers, N.Y., at 73; 132 shares, Flushing (L. I.) Gas Light Company, at 210.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

DEC. 21.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	150	150½
Central	500,000	50	150	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	200	205
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	233	237
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	.
Northern	150,000	50	79	80½
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	41	43
Preferred	2,000,000	100	72	74
Bonds 1st 5's	3,500,000	1,000	105	106
" 1st Con. 5's	1,500,000	..	94	96
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	83½	85½
Preferred	5,000,000	100	107	111
Bonds, 1st Mortgage, 5's	1,500,000	1,000	109½	..
Yonkers	299,650	50	180	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	89	91
" " Bonds (5's)	15 000,000	1,000	105½	106
Bay State	5,000,000	50	10¾	11⅛
" Income Bonds	2,000,000	1,000	25	30
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000		76
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	73¼	73⅜
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,069,000	..	..	65
1st Mortgage	1,085,000	..	..	96
Consumers, Jersey City	2,000,000	100	70	75
" Bonds	600,000	1,000	100	102
Cincinnati G. & C. Co.	7,000,000	100	201½	202
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	
Consolidated, Baltimore	1,000,000	100	62	63
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910.000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	32	33
" Con. Bonds	4,312,000	..	..	82
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	84	86
" Bonds	2,000,000	..	85	90
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	128	133
" Bonds, 6's	2,650,000	..	103	105
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	84	88
Bonds	1,000,000	1,000	85	90
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	24	24½
Preferred	2,500,000	100	70	80
Bonds	9,034,400	1,000	93	93¼
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	93	98
Bonds, 6's	4,000,000	..	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10.000,000	100	97¾	98¼
St. Paul Gas Light Co.	1,500,000	100	67½	70
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	500.000	25	..	..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	63	65
Bonds, 5's	3,556,000	.	90	93
Wilmington, Del.	500,000	50	180	182

Advertisers' Index.

GAS ENGINEERS.

	Page
Wm. Henry White, New York City	999
Fred. Bredel, Milwaukee, Wis.	985
Geo. R. Rowland, New York City	999
The Western Gas Construction Co., Fort Wayne, Ind.	990
Humphreys & Glasgow, New York City	986
T. G. Lansden, St. Louis, Mo.	999
American Gas Co., Phila., Pa.	981
David Leavitt Hough, New York City	1001

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md.	997
United Gas Improvement Co., Phila., Pa.	989
Burdett Loomis, Hartford, Conn.	998
National Gas and Water Co., Chicago, Ills.	991
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	997
The Western Gas Construction Co., Fort Wayne, Ind.	990

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City	1000
Continental Iron Works, Brooklyn, N. Y.	998
Deily & Fowler, Phila., Pa.	1000
Kerr Murray Mfg. Co., Fort Wayne, Ind.	996
Stacey Mfg. Co., Cincinnati, Ohio.	999
Bartlett, Hayward & Co., Baltimore, Md.	997
Davis and Farnum Mfg. Co., Waltham, Mass.	996
R. D. Wood & Co., Phila., Pa.	998
Isbell-Porter Company, New York City	998
Fred. Bredel, Milwaukee, Wis.	985
United Gas Improvement Co., Phila., Pa.	989
Berlin Iron Bridge Co., East Berlin, Conn.	986
National Gas and Water Co., Chicago, Ills.	991
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	967
The Western Gas Construction Co., Fort Wayne, Ind.	990
Humphreys & Glasgow, New York City	986
Gas Engineering Co., Pittsburgh, Pa.	996
American Gas Co., Phila., Pa.	981
Logan Iron Works, Brooklyn, N. Y.	980

SCRUBBERS AND CONDENSERS.

G. Shepard Page's Sons, New York City	999
R. D. Wood & Co., Phila., Pa.	998
James R. Floyd & Sons, New York City	1000
Continental Iron Works, Brooklyn, N. Y.	998
Gas Engineering Co., Pittsburgh, Pa.	996
Logan Iron Works, Brooklyn, N. Y.	980

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md.	997
Fred. Bredel, Milwaukee, Wis.	985
J. H. Gautier & Co., Jersey City, N. J.	994
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.	994
Adam Weber New York City	994

TAR AND CARBONIC ACID EXTRACTOR.

G. Shepard Page's Sons, New York City	999
R. D. Wood & Co., Phila., Pa.	998

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich.	979
G. Shepard Page's Sons, New York City	999
Gas Engineering Co., Pittsburgh, Pa.	996

GAS METERS.

John J. Griffin & Co., Phila., Pa.	964
American Meter Co., New York and Philadelphia	1003
The Goodwin Meter Co., Phila., Pa.	1002
Helme & McIlhenny, Phila., Pa.	1003
D. McDonald & Co., Albany, N.Y.	1003
Nathaniel Tufts, Boston, Mass.	1002
Maryland Meter and Mfg. Co., Baltimore, Md.	1002
Metric Metal Co., Erie, Pa	1002
Keystone Meter Co., Royersford, Pa.	980
Buhl Stamping Company, Detroit, Mich.	1003

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia	1003
John J. Griffin & Co., Phila., Pa.	1004
D. McDonald & Co., Albany, N. Y.	1003
Helme & McIlhenny, Phila., Pa.	1003

GAS AND WATER PIPES.

Ohio Pipe Co., Columbus, Ohio	1001
M. J. Drummond, New York City	1001
R. D. Wood & Co., Phila., Pa.	998
Warren Foundry and Machine Co., New York City	1001
Donaldson Iron Co., Emaus, Pa.	1001
Addyston Pipe and Steel Co., Cincinnati, O.	1001

PIPE CUTTERS.

Wm. Anderson, East Boston, Mass.	979

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, New York City	991

GAS COALS.

Penn Gas Coal Co., Phila., Pa.	993
Perkins & Co., New York City	992
Despard Gas Coal Co., Baltimore, Md.	993
Westmoreland Coal Co., Phila., Pa.	993
Berwind-White Coal Mining Co., New York and Phila.	992

CANNEL COALS.

Perkins & Co., New York City	992

GAS ENRICHERS.

Standard Oil Co., New York City	993
The Sun Oil Co., Pittsburgh, Pa.	993

COKE CRUSHER.

C. M. Keller, Columbus, Ind.	993

CONVEYING MACHINERY.

C. W. Hunt Company, N. Y. City	981

GAS GAUGES.

The Bristol Co., Waterbury, Conn.	981

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City	991
Isbell-Porter Co., New York City	998
The Wilder Mfg. Co., Phila., Pa	980
R. D. Wood & Co., Phila., Pa.	998

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City 998
Continental Iron Works, Brooklyn, N.Y. 998
G. Shepard Page's Sons, New York City 999
Logan Iron Works, Brooklyn, N. Y. 980

CEMENTS.

C. L. Gerould & Co., Mount Vernon, N.Y. 994

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J. 994
B. Kreischer & Sons, New York City 994
Adam Weber, New York City 994
Laclede Firebrick Mfg. Co., St. Louis, Mo. 994
Cyrus Borgner, Phila., Pa. 994
James Gardner, Jr., Pittsburgh, Pa. 994
Henry Maurer & Son, New York City 994
Baltimore Retort and Firebrick Co., Baltimore, Md. 994
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 994
Brooklyn Firebrick Works, Brooklyn, N. Y. 994
F. Behrend, New York City 979

INCANDESCENT GAS LAMPS.

Welsbach Commercial Co., Phila., Pa. 983

MICA GOODS.

The Mica Mfg. Co., New York City 981

BURNERS.

C. A. Gefrorer, Phila., Pa. 998
Theo. Clough, Dobbs Ferry, N. Y. 979

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn. 979

GAS TUBING.

Wm. M. Crane & Co., New York City 902

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 991
Greenpoint Chemical Works, Brooklyn, N.Y. 991
Henry W. Douglas, Ann Arbor, Mich 991

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind 988
Isbell-Porter Company, New York City 998
Connelly Iron Sponge and Governor Co., New York City 991

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. 990
Chapman Valve Manufacturing Co., Boston, Mass. 990
R. D. Wood & Co., Phila., Pa. 998
Continental Iron Works, Brooklyn, N. Y. 998
The P. H. & F. M. Roots Co., Connersville, Ind 988
Isbell-Porter Co., New York City 998
The Western Gas Construction Co., Fort Wayne, Ind. 990

ELECTRICAL APPARATUS.

Wm. Henry White, New York City 999

GAS ENGINES.

Otto Gas Engine Works, Phila., Pa. 1004
The American Gas Engine Co., Phila., Pa 995
Backus Water Motor Co., Newark, N. J. 979

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City 981
W. G. & G. Greenfield, East Newark, N. J. 879

PURIFIER SCREENS.

John Cabot, New York City 984

GAS STOVES.

American Meter Co., New York and Philadelphia 987
The Goodwin Meter Co., Phila., Pa. 1002
George M. Clark & Co., Chicago, Ills. 985
Maryland Meter and Manufacturing Co., Baltimore, Md. 1002
William M. Crane & Co., New York City 902
Keystone Meter Co., Royersford, Pa. 980
A. Weiskittel & Son, Baltimore, Md. 984

CHINA GAS KILNS.

William M. Crane & Co., New York City 902

GASHOLDER PAINT.

New York Marine Paint Co., Poughkeepsie, N. Y 990

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y 990

DIVIDEND NOTICE.

OFFICE OF WELSBACH LIGHT CO.,
DREXEL BUILDING, PHILA., Dec. 9, 1896.

The Directors have this day declared a dividend of twenty (20) per cent. ($1 per share), payable December 23d, 1895, to stockholders of record at the close of business Dec. 15th. Checks will be mailed.

1110-2 EDWARD C. LEE, Treasurer.

"STOVE CLERK,"

In the Office of a New York Gas Co.,

whose principal business is to demonstrate gas burning, heating and cooking apparatus, would like employment, after 5 P.M., at the Gas Exposition to be held in January.

1124-1 Address "S. M. F.," care this Journal.

ENGAGEMENT DESIRED.

An English Gas Engineer and Chemist, late teacher of gas manufacture, "City and Guilds of London Institute," author of numerous papers, thoroughly up to date in all departments of coal, oil and water gas, gas lighting, heating, working of residuals, etc., is open to accept appointment as Superintendent, Representative (to reliable firm) or Examiner. Highest references and testimonials as to ability, training, etc. Address, with particulars,

1122-5 "G. A.," care this Journal.

Position Desired

As Superintendent of Gas Works or Gas and Electric Light Works,

By a man 34 years of age. Sixteen years' experience in the manufacture and distribution of Coal Gas as Supt., and four years in the Electric line. Thoroughly competent to take charge of any plant, separately or combined. A practical mechanic, and understands the erection of gas plants and everything pertaining to the business. Not afraid of work. Salary no object until ability is proven. Best of references.

1102-tf Address "M. E. J.," care this Journal.

FOR SALE.

Interest in Coal Gas Plant in Town of 15,000 Population,

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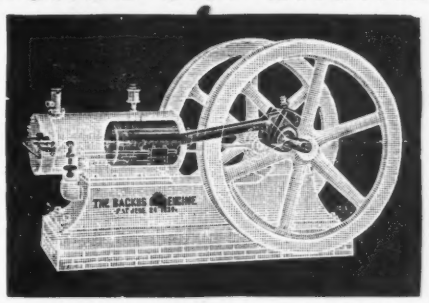

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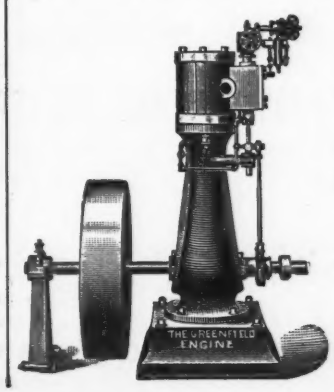

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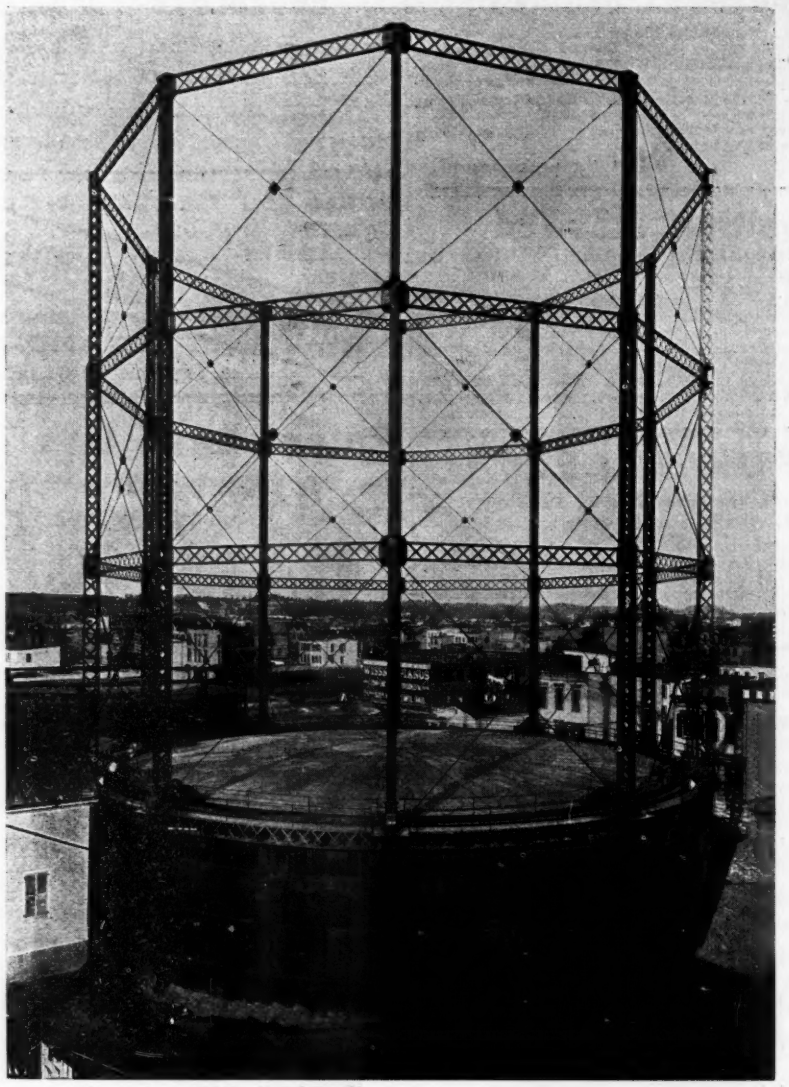

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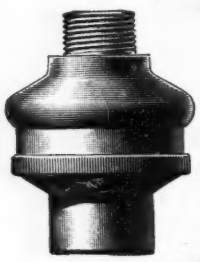

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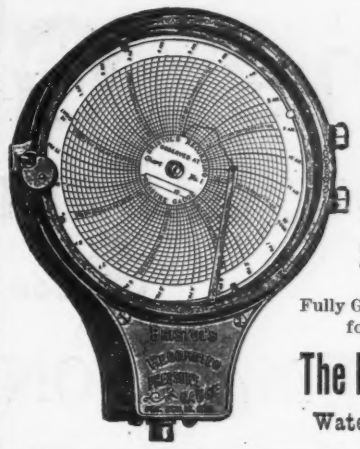

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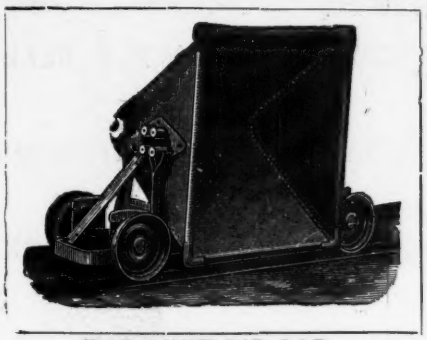

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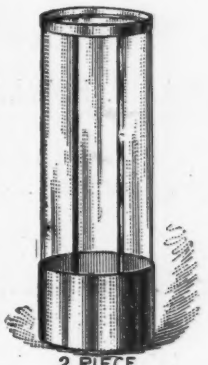

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PROSPECTUS.

THE object of the **Gas Exposition** is to bring together a collection of gas apparatus and appliances of every description, for the two-fold purpose of affording the general public and the gas engineer an opportunity to study the developments that have taken place in the gas industry during recent years. In submitting the plan of the Exposition to those who may feel an interest in the project, the management would call the attention of manufacturers of supplies of every description, entering into the manufacture of gas, to the great benefits which similar affairs have conferred on the industries of Great Britain, Germany and France, in which countries the exhibitions of gas appliances are held with recurring frequency. The creation of a healthy public sentiment in favor of gas is one of the first aims of large numbers of foreign gas companies.

MADISON SQUARE GARDEN.

In the selection of New York for the inauguration of an enterprise of this character, it is believed that no mistake has been made. In this city the Madison Square Garden is looked upon as one of the great show places of the metropolis; it contains within its walls the requisite space for the proper display of an almost unlimited amount of product, without which an affair of this kind cannot hope for the stamp of public approval—hence the selection of this great building for the inauguration of the gas industries exposition during the two weeks beginning January 25, 1897.

The greater New York contains a resident population of 3,000,000 people. Within a radius of 50 miles of Madison Square Garden live 4,500,000 people; reliable statistics show that an average of fully 100,000 strangers visit New York every day in the year. Thus it will be seen that the gas exposition will draw from a population of fully 6,000,000. In this connection it ma be stated that every effort will be put forth that ingenuity can devise to thoroughly advertise the exposition, and create a desire in the minds of the public to come to the show; and once within its portals the dazzling brilliancy there abounding, coupled with the many attractive and instructive exhibits, will cause the visitor to wish to come again.

It is expected that cooking demonstrations will be a feature of the exposition. The lecture and concert hall, situated conveniently near the great amphitheater, in which the exposition is to take place, affords seating room for 1,200 to 1,400 people. The most experienced and talented ladies obtainable will be selected for this feature of the affair, which must prove one of the show's greatest attractions; not only for the housewives who may be attracted to it, but for gas managers, who will thus have an opportunity to study the advantages these gas cooking demonstrations offer as one of the means at hand for the education of people in the uses of gas.

INJUNCTION ISSUED AGAINST INFRINGERS.

On September 23d the United States Circuit Court for the Southern District of New York granted an injunction restraining and enjoining the further infringement of our Welsbach patent. READ IT.

UNITED STATES CIRCUIT COURT,
Southern District of New York.

WELSBACH LIGHT COMPANY,
vs.
A. LIEBES.
} IN EQUITY.

The President of the United States,

TO A. LIEBES, and his servants, agents, attorneys and workmen, GREETING:

WHEREAS, It has been represented to us in our Circuit Court of the United States for the Second Circuit and Southern District of New York, that Letters Patent of the United States No. 438,125, were issued in due form of law on the 7th day of October, 1890, to Carl Auer von Welsbach, assignor of the complainant, then known as "Welsbach Incandescent Gas Light Company of New Jersey," and that the complainant herein is the owner of said Letters Patent, and that you, the said A. Liebes, have infringed the rights secured by the aforesaid Letters Patent, by making, using and selling to others to be used, incandescent devices for gas burners, embodying and containing the invention and improvements described and claimed in said Letters Patent No. 438,125.

NOW, THEREFORE, We do strictly command and enjoin you, the said A. Liebes, and your attorneys, agents, servants and workmen, under the penalties which may fall upon you in case of disobedience, that you forthwith and forever desist from directly or indirectly making, or causing to be made, delivering, vending, or causing to be sold, offering for sale, using, or causing to be used in any manner, any incandescent devices for gas burners, like, or similar to those which you have heretofore made, used or sold, containing or embodying the invention and improvements described in said Letters Patent No. 438,125, and claimed in the claim thereof, and from counterfeiting or imitating the said invention or improvements or any part or parts thereof, and from in any manner or way whatsoever, violating or infringing the said Letters Patent No. 438,125 and the claim thereof, and from doing, or causing to be done, any other act or thing whatsoever in infringement of the said Letters Patent No. 438,125.

WITNESS, The Honorable Melville W. Fuller, Chief Justice of the United States, at the City of New York, in the Southern District of New York, this twenty-fourth day of September, A. D., 1896.

(SEAL) JOHN A. SHIELDS, Clerk.

(Endorsed) U. S. Circuit Court, Southern District of New York, in Equity.—Welsbach Light Company vs. A. Liebes. Injunction.

A Copy of a Writ of Injunction this day issued out of my office. JOHN A. SHIELDS, Clerk.

We shall proceed against all infringers; manufacturers, dealers and users being equally liable to injunction and damages. The decree of the court awarding the injunction also awards profits and damages. Do not be misled or deceived by guarantees offered by infringers, as such guarantees will not protect you against suit, injunction and damages. For your own protection see that you get the genuine Welsbach light. All other incandescent gas lights are infringements.

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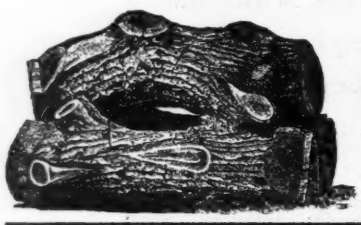

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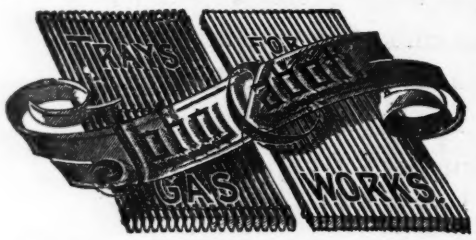

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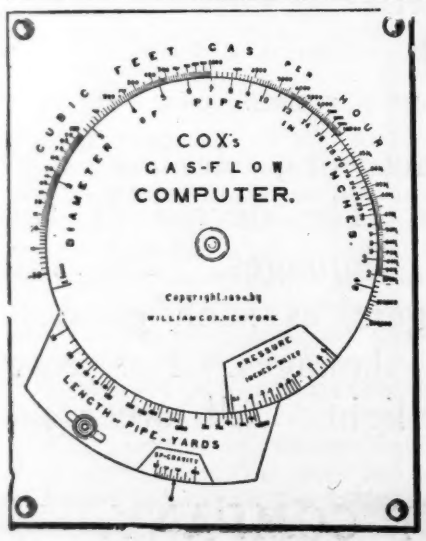

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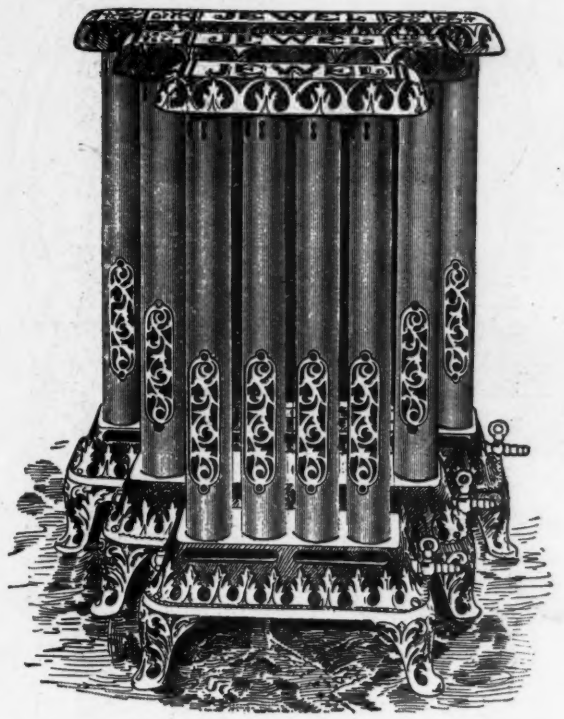

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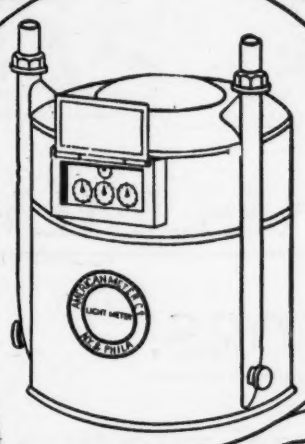
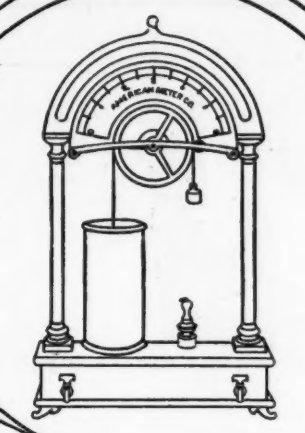
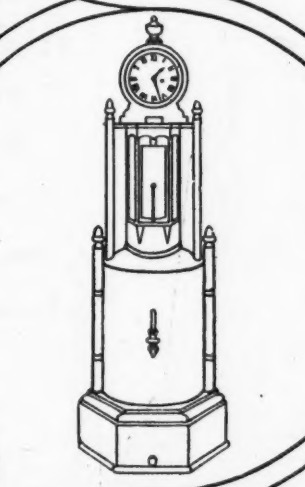
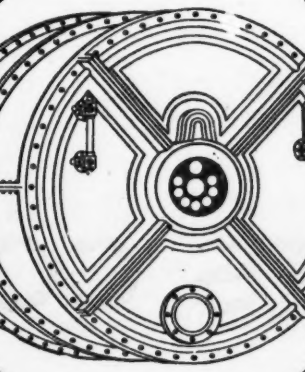








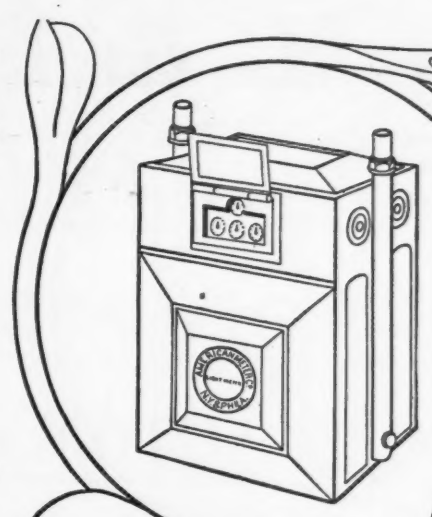
PUBLIC LIGHTING TABLE.

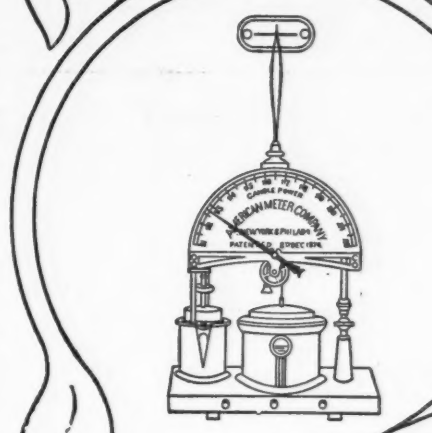
JANUARY, 1897.

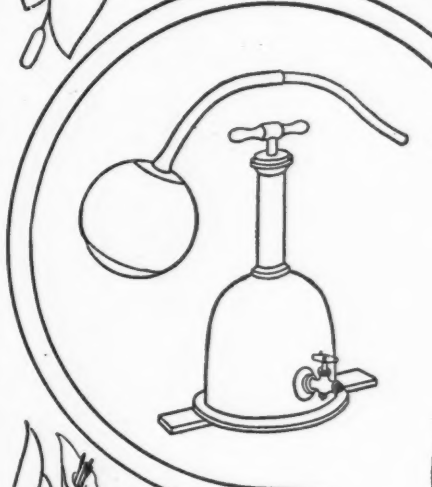
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Fri.	1	5.10 PM	6.20 AM	4.30	6.30
Sat.	2	5.10 NM	6.20	4.30	6.30
Sun.	3	5.20	6.20	4.30	6.30
Mon.	4	5.20	6.20	4.30	6.30
Tue.	5	5.20	6.20	4.30	6.30
Wed.	6	5.20	6.20	4.30	6.30
Thu.	7	8.50	6.20	4.30	6.30
Fri.	8	9.50	6.20	4.40	6.30
Sat.	9	10.50	6.20	4.40	6.30
Sun.	10	11.50 FQ	6.20	4.40	6.30
Mon.	11	12.50 AM	6.20	4.40	6.30
Tue.	12	1.50	6.20	4.40	6.30
Wed.	13	2.50	6.20	4.40	6.30
Thu.	14	3.50	6.20	4.40	6.30
Fri.	15	4.50	6.20	4.50	6.25
Sat.	16	5.40	6.20	4.50	6.25
Sun.	17	No L.	No L.	4.50	6.25
Mon.	18	No L. FM	No L.	4.50	6.25
Tue.	19	No L.	No L.	4.50	6.25
Wed.	20	5.40 PM	8.20 PM	4.50	6.25
Thu.	21	5.40	9.30	4.50	6.25
Fri.	22	5.40	10.40	5.00	6.25
Sat.	23	5.40	11.50	5.00	6.25
Sun.	24	5.40	1.10 AM	5.00	6.25
Mon.	25	5.40 LQ	2.20	5.00	6.25
Tue.	26	5.40	3.40	5.00	6.25
Wed.	27	5.40	4.50	5.00	6.25
Thu.	28	5.40	5.50	5.00	6.25
Fri.	29	5.40	6.10	5.05	6.15
Sat.	30	5.40	6.10	5.05	6.15
Sun.	31	5.50	6.10	5.05	6.15

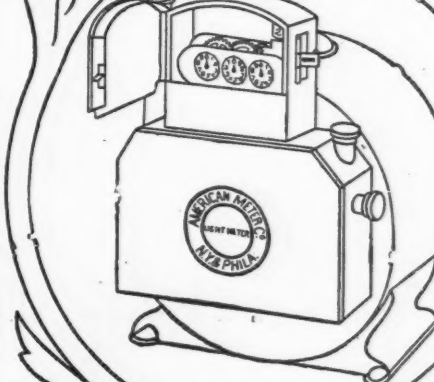
TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	233.00	January	423.20
February	187.20	February	355.25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151.40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45









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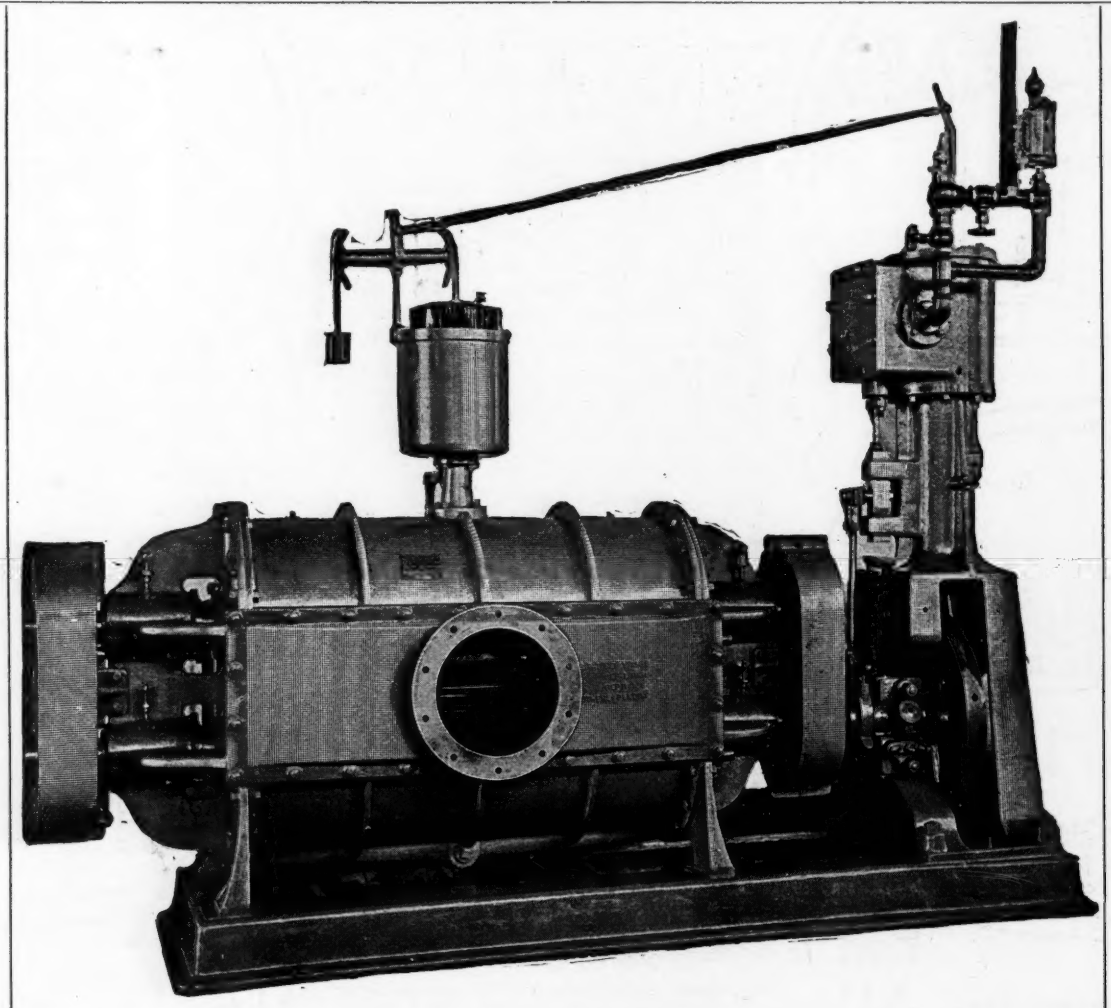

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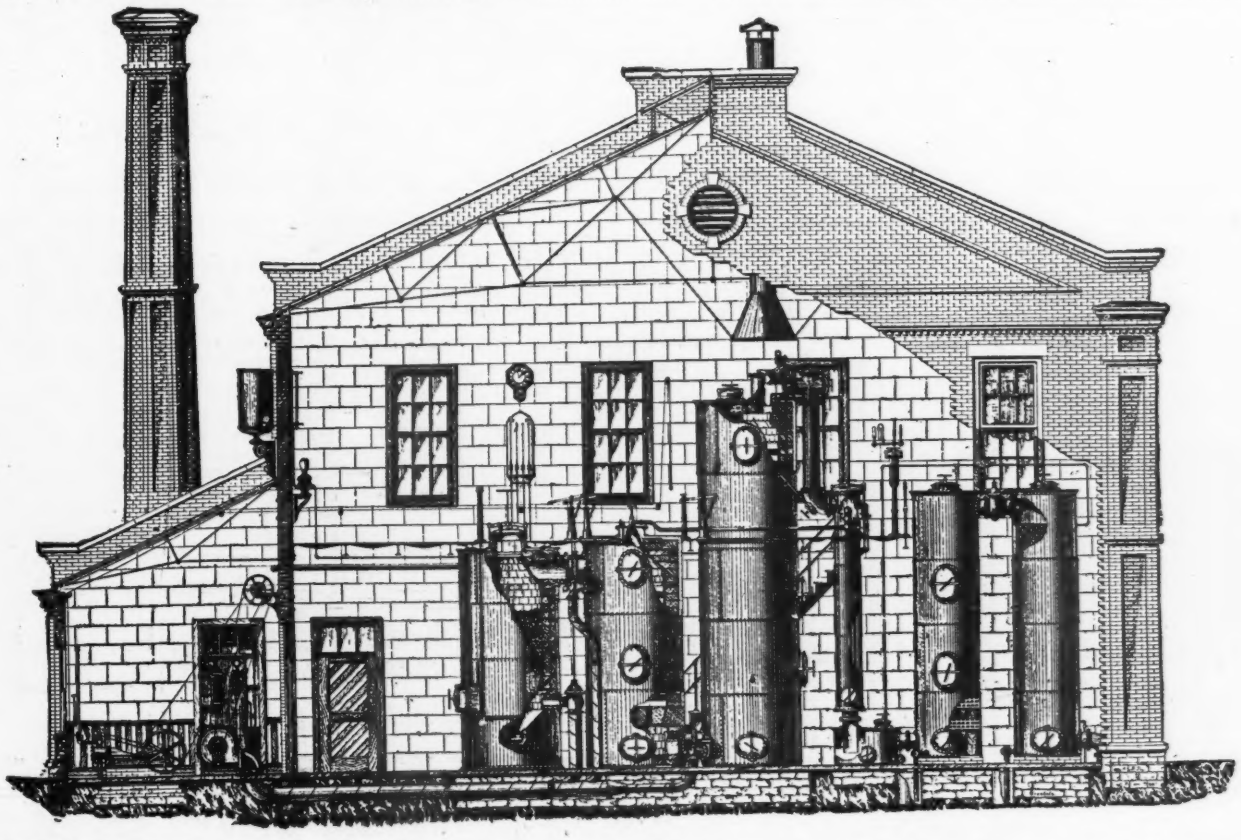

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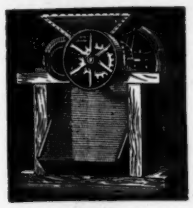

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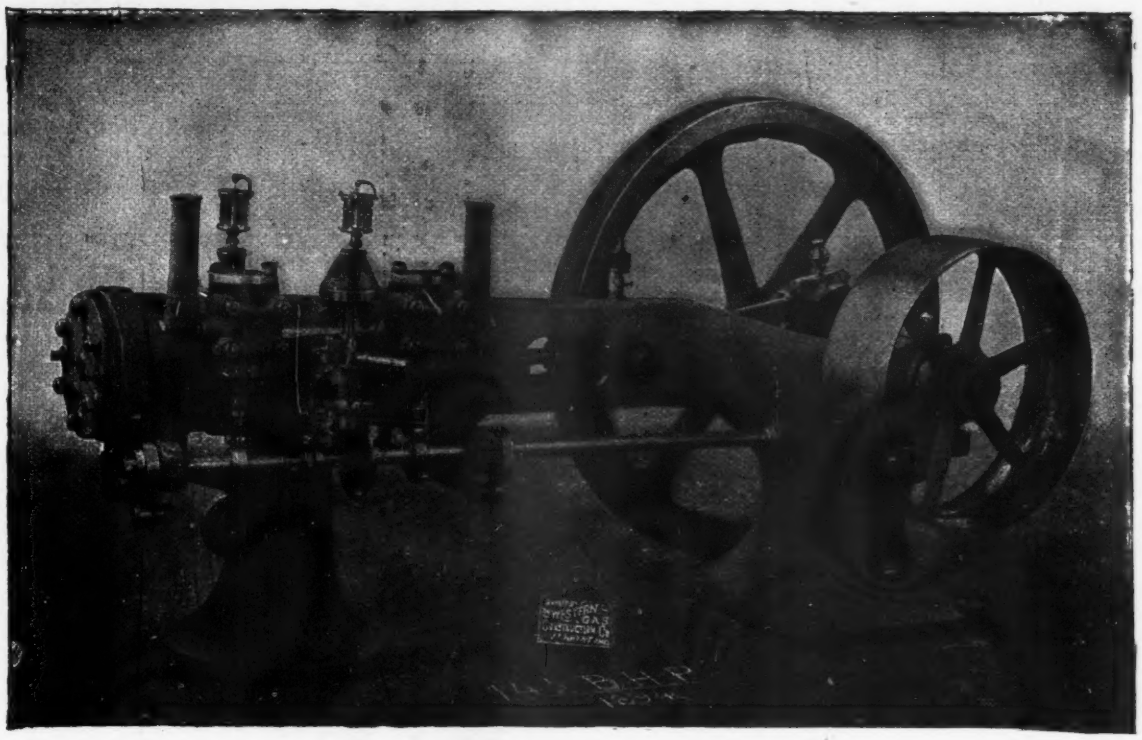

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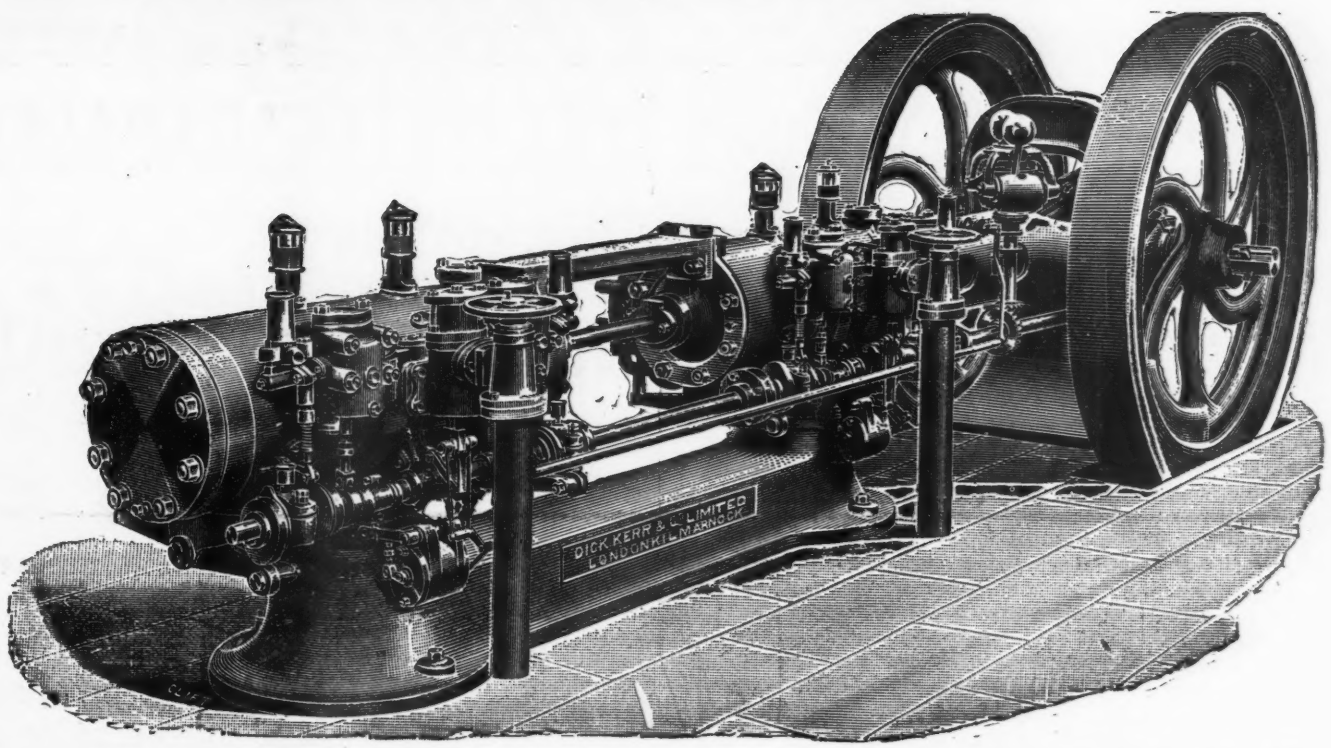

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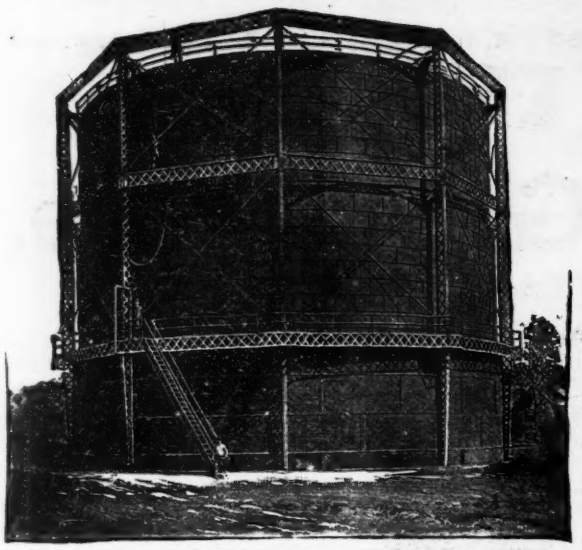

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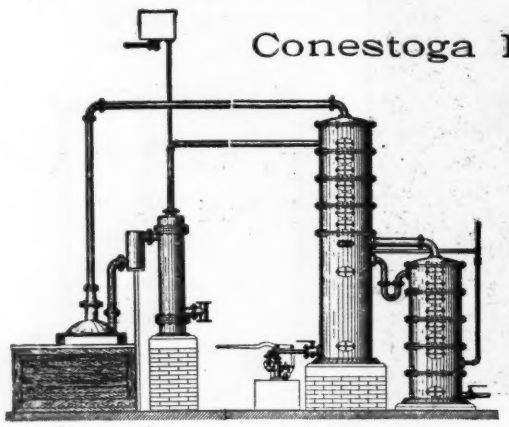

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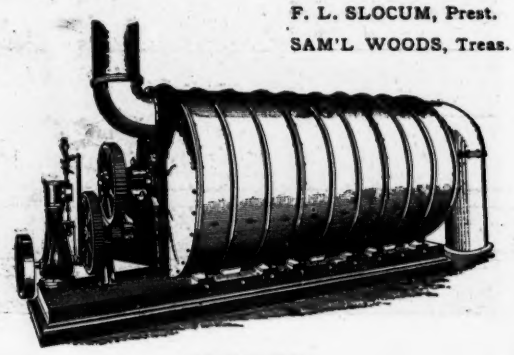

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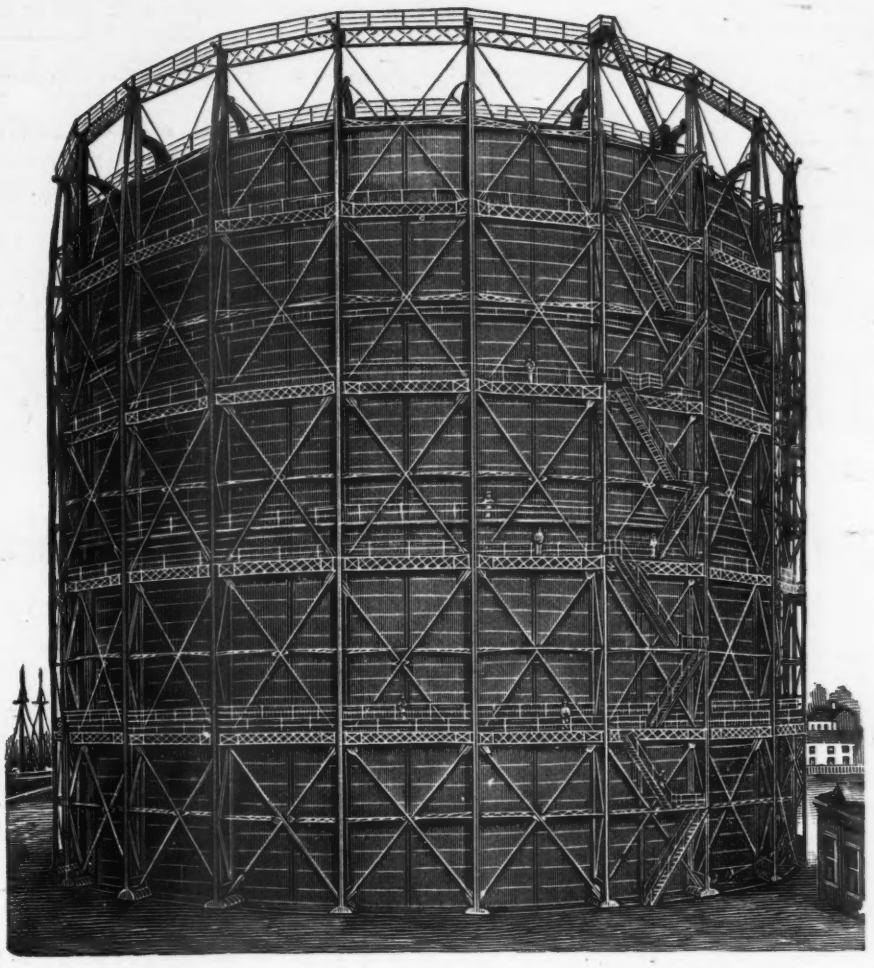

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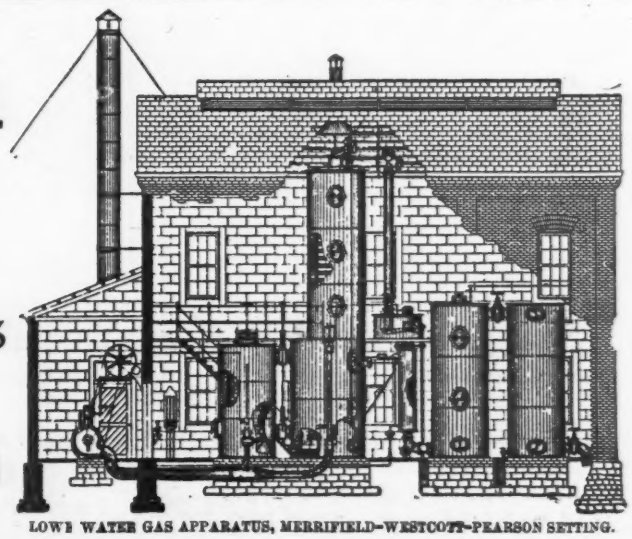

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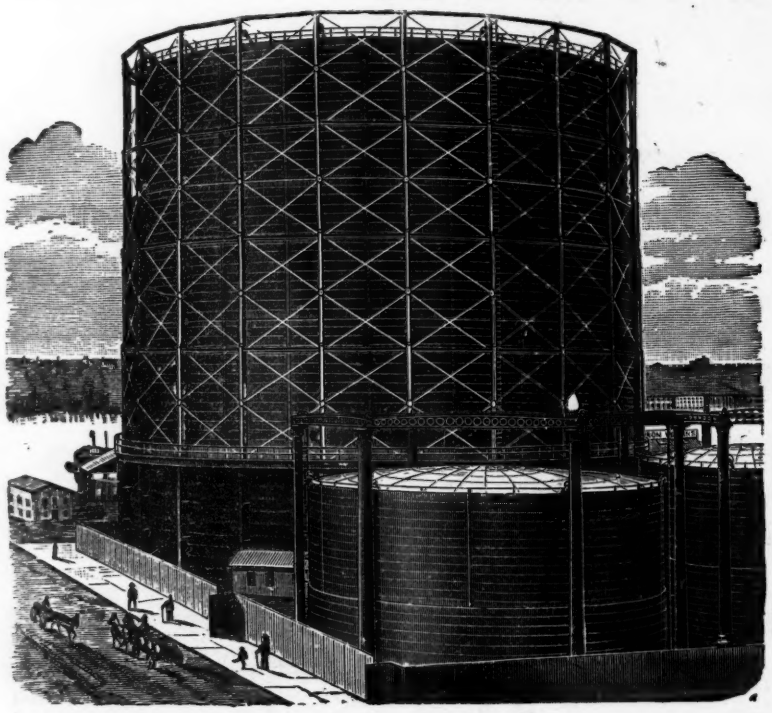

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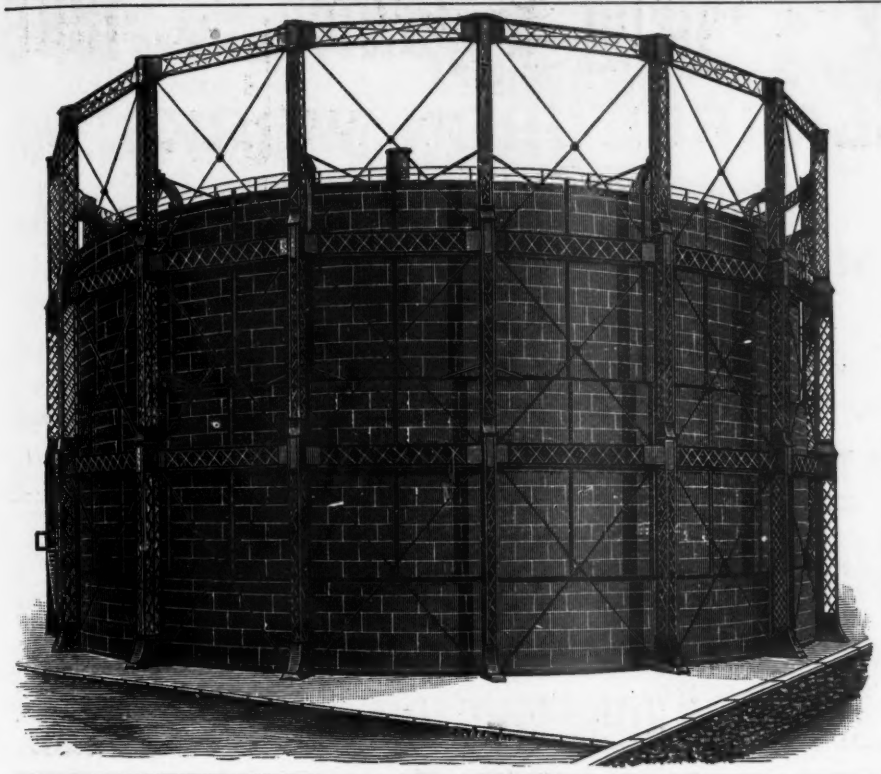

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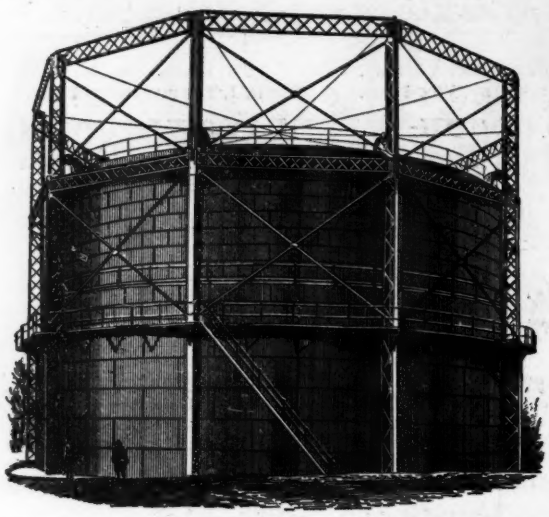

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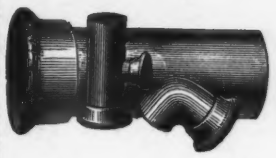

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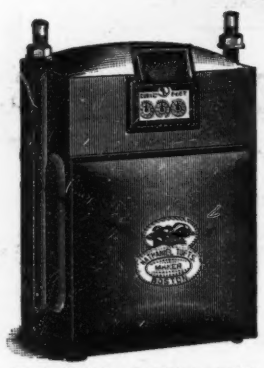

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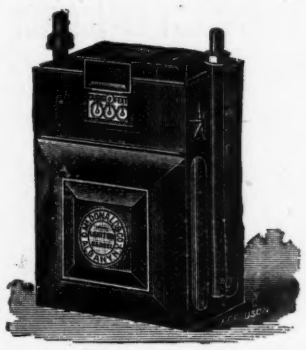

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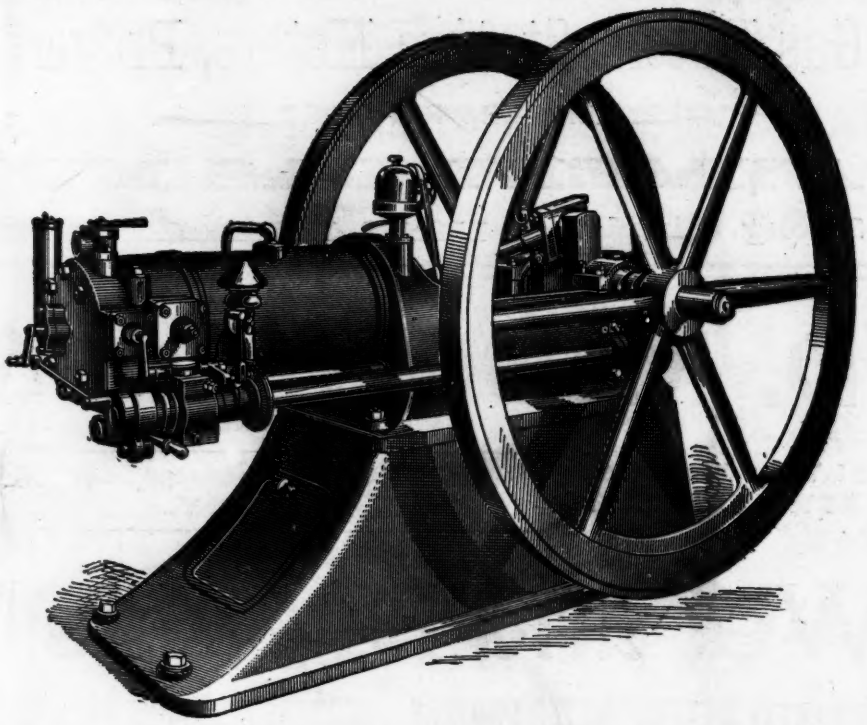

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